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WAR MACHINE

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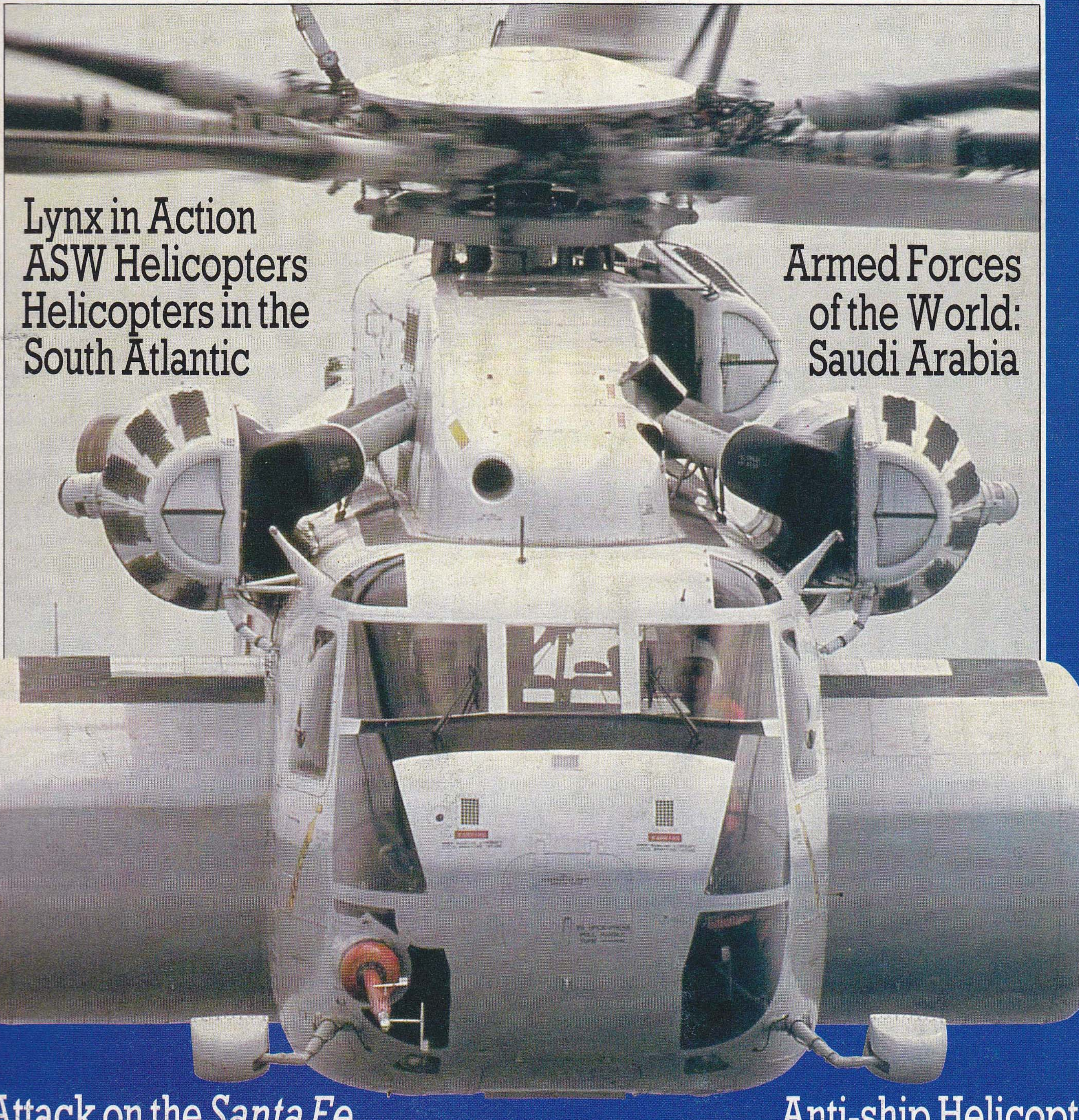

Lynx in Action
ASW Helicopters
Helicopters in the South Atlantic

Armed Forces of the World: Saudi Arabia

The Attack on the *Santa Fe*

Anti-ship Helicopters

An illustrated guide to the world's naval helicopters

WAR MACHINE

Volume 1 **Issue 11**

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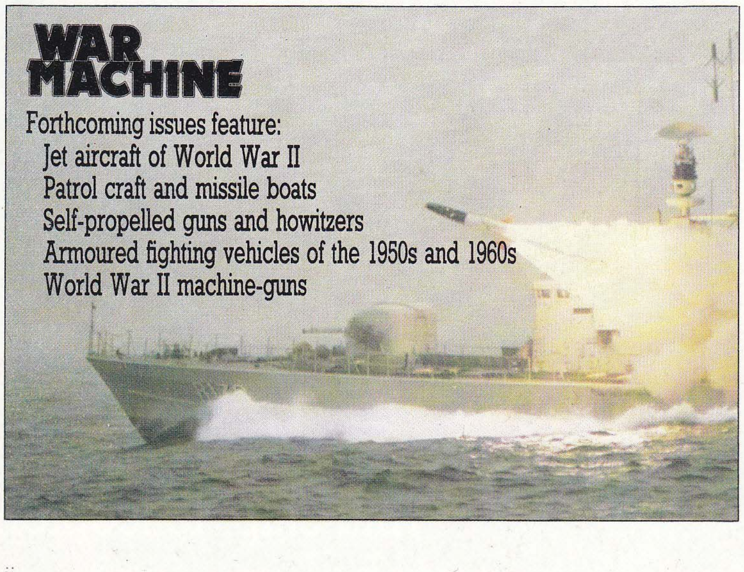

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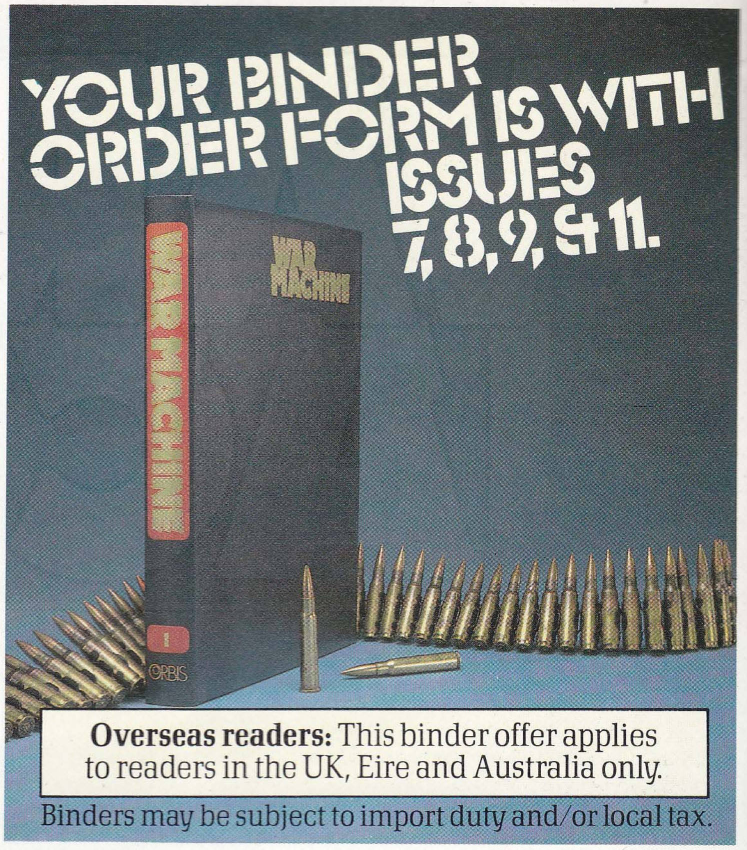

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Naval Helicopters

The Westland Sea King, of which this example serves with Australia, is among the world leaders in ASW capability.

In the past few years naval helicopters have proved themselves major weapon assets. They have seen active service in Iran, Lebanon, Sweden, Norway and the South Atlantic, and they will rapidly become a dominant factor in future naval operations.

The great advantage of the helicopter is its ability to take off and land vertically. This is valuable on land in that it enables helicopters to fly where there are no airfields, and (for example) let troops abseil down a rope into dense tropical rain forest. But how much more valuable is the VTOL (vertical take-off and landing) capability in a naval machine! It means that such a machine can go to sea aboard any kind of ship big enough to support it and with a deck area sufficient for landing.

From the earliest post-war days naval helicopters have been used for utility tasks, liaison, reconnaissance, vertrep (the vertical replenishment of warships under way at sea) and commando-style assault on enemy beaches. Others bring out casualties on stretchers (litters) or carry out the vital mission called SAR (search and rescue), which demands a reliable personnel hoist with a typical lifting distance of 76 m (250 ft) and a rating of 272 kg (600 lb) so that it can bring up both the rescuee (who may be unconscious) plus a crewman.

Today the two chief naval missions for helicopters are ASW (anti-submarine warfare) and ASV (anti-surface vessel) attack. Early helicopters could not fly these missions because they could not carry the sensors and weapons needed. Today such machines as the Sikorsky/Westland Sea King, Westland Lynx, Sikorsky Seahawk and Kamov Ka-25 can fly such missions even in very bad weather, while in Operation 'Corporate' (the retaking of the Falkland Islands in 1982) British naval helicopters flew around the clock, often in appalling weather, and were absolutely crucial to the entire operation.

One has only to study the statistics of the sorties flown (and of the tasks accomplished) by the Sea King, Lynx, Westland Wessex and Westland Wasp helicopters of the Task Force to see that without them the Royal Navy's ships would have been torpedoed, hostile submarines would have escaped destruction, hostile surface vessels would have been able to operate (at least by night) with some measure of impunity, vital reconnaissance information would not have been forthcoming, and (most important of all) the entire operation would have ground to a halt from a total lack of transport, except for a single surviving RAF Boeing Vertol Chinook! Moreover, despite the fact that virtually the entire Argentine navy stayed away (notably excepting its aircraft), British naval helicopters knocked out a submarine and several small surface ships, as well as a land HQ for good measure.

The machines described in the following pages are often special versions of helicopters also used in land-based roles. Invariably the naval missions are more challenging, and call for extra capabilities.

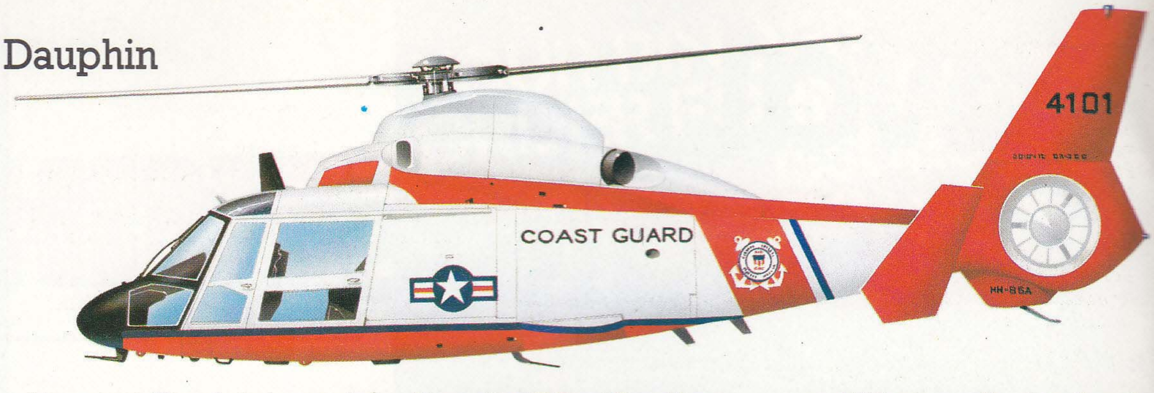
The Falklands war was a campaign won by the naval helicopter. Amongst the heroes was this Westland Wessex, XP142. 'Humphrey', as it was known, depth-charged an Argentine submarine, rescued a reconnaissance party from occupied South Georgia, got hit in the San Carlos landings and generally gave sterling service.

FRANCE

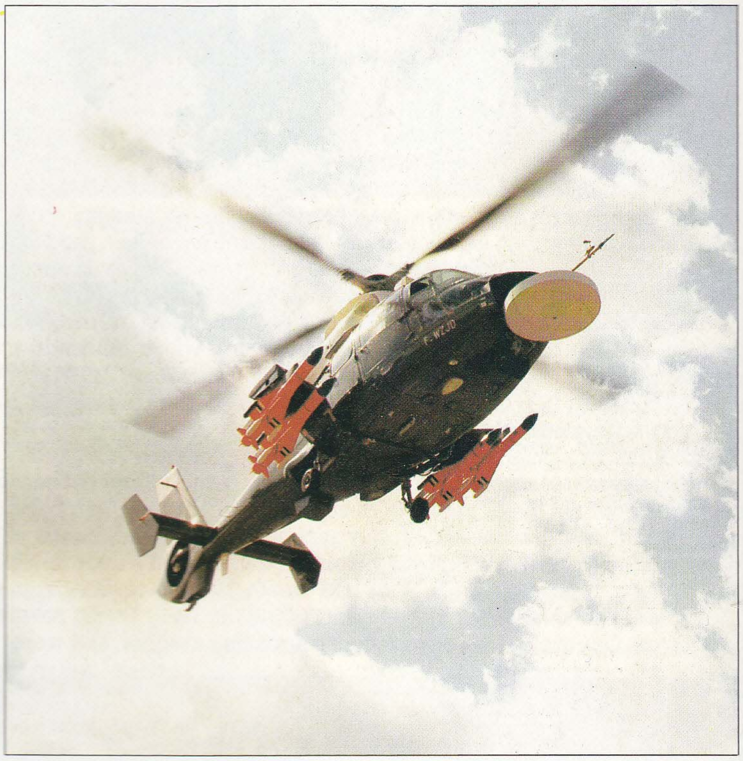
Aérospatiale Dauphin

The **Aérospatiale Dauphin** was originally planned as a modern replacement for the mass-produced Alouette III, but it quickly diversified into a large family with different fuselages, landing gears (fixed tailwheel type with forward spatted mainwheels or retractable tricycle gear, for example) and various single or twin engines. The original **SA 360C Dauphin** introduced the four-blade 'Starflex' main rotor of 11.50 m (37 ft 8¾ in) diameter, driven by a Turboméca Astazou XVIIIA turboshaft rated at 783 kW (1,050 shp). The first flew on 2 June 1972, and it was followed on 24 January 1975 by the first **SA 365C** powered by two 492-kW (660-shp) Turboméca Arriel engines. These earlier versions were superseded by the **SA 365N Dauphin 2** and its derivatives, which have a new structure making extensive use of composite materials such as glassfibre, Nomex, Kevlar and Rohacell, and with carbon-fibre composite in the spars of the rotor blades. The SA 365N also features fully retractable tricycle landing gear, and is one of the fastest of all current helicopters, having set many world point-to-point speed records including Paris-London in 63 minutes at an average of just over 322 km/h (200 mph). In 1979 Aérospatiale beat strong US competition with a derived model, the **SA 366G**, powered by two Avco Lycoming LTS101 engines of 507 kW (680 shp) each; an initial order of 90 was placed by the US Coast Guard which calls its very fully equipped offshore patrol model the **HH-65A Dolphin**. An even bigger contract gained in 1980 by France was the vast 'Sawari' order for military equipment for Saudi Arabia. Part of this comprised 24 **SA 365F Dauphin 2** helicopters of a new type, the final 20 being equipped with four AS.15TT anti-ship missiles. This anti-ship Dauphin, which is intended to compete with the already existing Lynx with Sea Skua missiles, was developed with Saudi funds and has a Thomson-CSF Agrion radar which provides guidance for the AS.15TT, which itself was financed by this contract. The missile is expected to be effective over ranges up to 15 km (9.3 miles). Aérospatiale also intends to sell Dauphin 2 helicopters for ASW, SAR and other naval duties, the former mission being flown with sonobuoys (with later provision for sonar), MAD and two homing torpedoes.

Specification:
Aérospatiale SA 365F Dauphin 2
Type: anti-ship attack helicopter
Powerplant: two 710-shp (529-kW) Turboméca Arriel turboshafts
Armament: four Aérospatiale AS.15TT radar-guided missiles
Performance: maximum cruising speed (clean) 252 km/h (156 mph) at sea level and 259 km/h (161 mph) at medium height; range (maximum fuel, sea level) 898 km (558 miles); endurance (with maximum fuel) 4 hours 25 minutes, or (two missiles) 3 hours 45 minutes, or (four missiles) 2 hours 45 minutes
Weights: empty 2141 kg (4,720 lb); maximum take-off 3900 kg (8,598 lb)
Dimensions: main rotor diameter 11.93 m (39 ft 1¾ in); fuselage length 12.11 m (39 ft 8¾ in); height 3.99 m (13 ft 1 in); main rotor disc area 111.7 m^2 (1,202.4 sq ft)



Above: The US Coast Guard have acquired 90 HH-65A Dolphins for short range recovery tasks which, though not requiring offensive capabilities, means the aircraft must have the latest maritime search and surveillance equipment.



The newly-proposed Dauphin 2 displays its four AS.15TT anti-ship missiles and bulbous radome housing the Agrion 15 radar system. This highly effective kit enables the aircraft to detect at long ranges and track 10 surface targets.

FRANCE

Aérospatiale Super Frelon

The largest helicopter to be produced in quantity in Western Europe, the **Aérospatiale Super Frelon** was built mainly for air force, army and commercial customers, with regular land-type landing gear. The first production model, however, was the **SA 321G**, of which 24 were supplied to the French Aéronavale in 1966-70. They are used by Flottille 32F based at Lanvéoc-Poulmic in Brittany, where among other duties they have the vital task of supporting the French national deterrent by shadowing each 'Redoutable' class strategic missile submarine as it departs from its base at the Île Longue on combat patrol. The whole point of the submarine-based deterrent is that its location should be unknown to a potential enemy, and should a submarine be followed by another submarine belonging to a potentially hostile power its future position would clearly always be known. Thus the SA 321G helicopters of 32F make certain that there is no other submarine anywhere in the vicinity as each French missile submarine goes on patrol. To be effective the friendly vessel should be accompanied for the greatest possible distance, and here the large size and long range of the Super Frelon is an advantage. All Super Frelons have a six-blade main rotor in order to absorb the power of the three engines within the same diameter as the much lighter twin-engined S-61 Sea King. The cockpit is occupied by the pilot and co-pilot, who have the services of comprehensive navaids and communications systems including Doppler, while in the main tactical compartment is the mission crew of three

The primary mission of the Aéronavale's Super Frelon is the prevention of Soviet submarines shadowing French missile-carrying submarines as they leave port. This model has also fired Exocet missiles in anti-ship trials, but the helicopter does not normally carry these weapons.

who manage the detection, tracking and attack equipment. When delivered the SA 321G helicopters were fitted with ORB 31 Héraclès I radar in the nose, but since 1981 they have been converted to take the ORB 32 Héraclès II which has 360° all-round coverage and twice the operating power. There is a main tactical display on which the returns from a dipping sonar can also be presented, and other equipment includes towing and MCM (mine countermeasures) gear and a rescue hoist of 275 kg (606 lb) capacity. Frequently these large machines operate in groups of three or even four, to make certain no submarine could escape detection.

Specification

Type: ASW and ASV shore-based helicopter

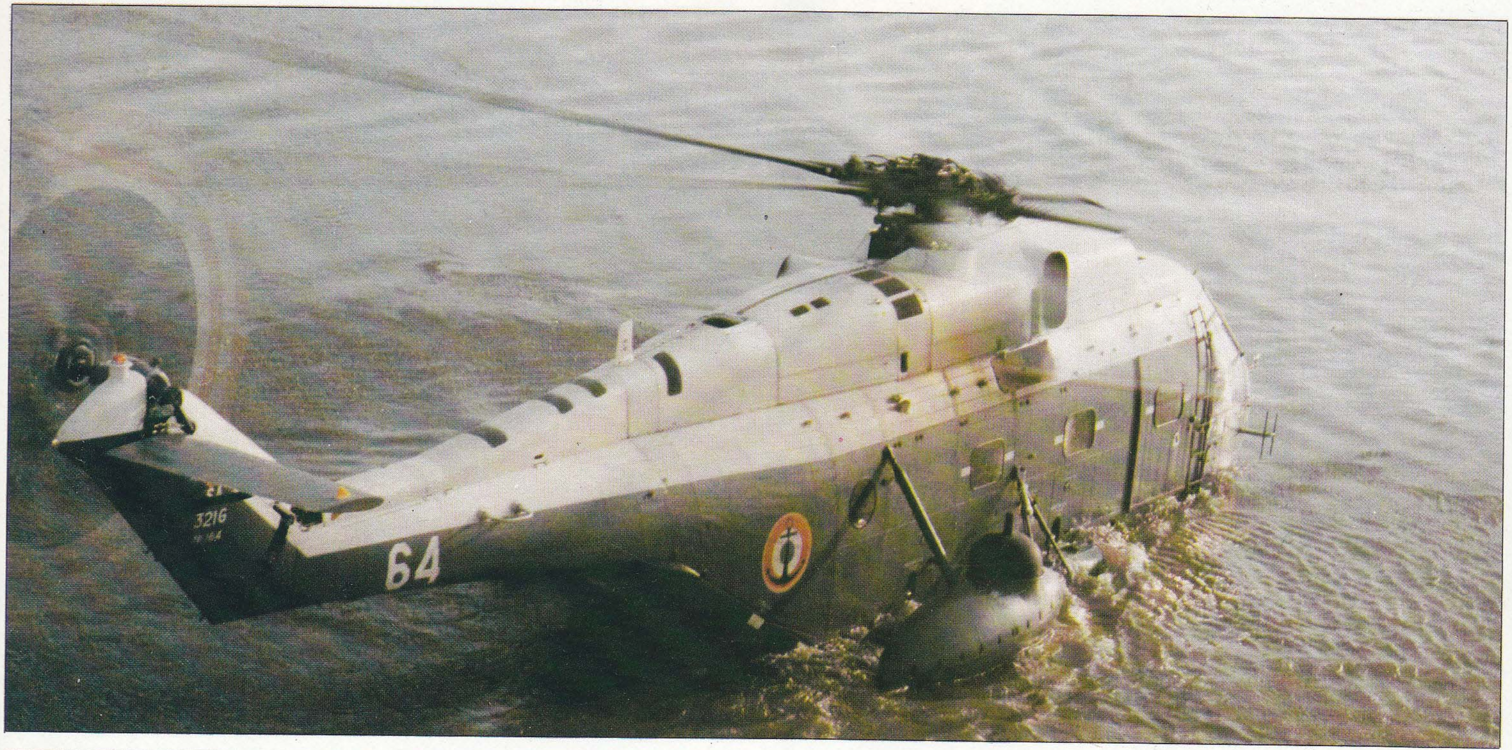
Powerplant: three 1,570-shp (1171-kW) Turboméca Turmo IIIC6 turboshafts

Armament: up to four homing anti-submarine torpedoes or two AS.39 Exocet anti-ship missiles

Performance: cruising speed 248 km/h (154 mph); range with 3500-kg (7,716-lb) mission load 1020 km (633 miles); endurance in ASW role 4 hours

Weights: empty 6863 kg (15,130 lb); maximum take-off 13000 kg (28,660 lb)

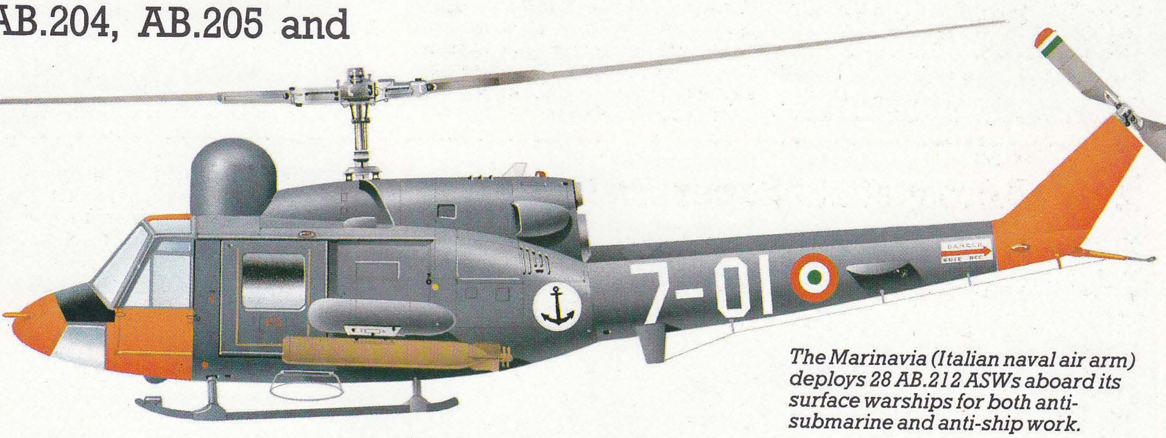
Dimensions: main rotor diameter 18.90 m (62 ft 0 in); length overall 23.0 m (75 ft 6½ in); height 6.76 m (22 ft 2¼ in); main rotor disc area 280.5 m^2 (3,019.0 sq ft)



One useful attribute of the Super Frelon is its ability to put down at sea. The sealed hull is a feature borrowed from the Sikorsky S-61.

ITALY

Agusta-Bell AB.204, AB.205 and AB.212



The Marinavia (Italian naval air arm) deploys 28 AB.212 ASWs aboard its surface warships for both anti-submarine and anti-ship work.

The Italian company Costruzione Aeronautiche Giovanni Agusta has built Bell helicopters under licence since 1952. Large numbers of the Model 204, the first and smallest member of the 'Huey' family, were built under the designation **Agusta AB.204** for many customers, some of them (including the Swedish navy version) being powered by a Rolls-Royce Gnome turboshaft in place of the usual T53. Production switched in 1966 to the larger multi-role **AB.205,** and went on in 1971 to include the twin-engined **AB.212**. In contrast to Bell Helicopter Textron, which has concentrated on 'Huey' models for army and air force customers, Agusta has placed much emphasis on a special **AB.212ASW** version, extensively redesigned and fully equipped for anti-submarine warfare, with secondary roles which include anti-ship missile attack and SAR (search and rescue). The basic ASW role equipment includes a search radar specially designed for good discrimination in rough seas, with the rotating scanner above the cockpit. The radar is automatically linked to the AB.212ASW navigation system (Tacan, Doppler radar, UHF homer and navigation computer) to give a continuously updated picture of the overall tactical situation. There is an advanced flight-control and auto-stabilization system, one of its modes being auto-approach to hover at a chosen spot and at a height set by the radar altimeter. An IFF/SIF transponder is fitted, and various advanced ECM systems can be installed. The basic ASW sensor is a low-frequency variable-depth sonar usable down to a depth of 137 m (450 ft). The auto flight control can hold the helicopter stationary over any chosen 'dip point' in a complex sonar search pattern. ASW weapons are listed separately. In the anti-ship mission guided missiles of various kinds may be carried, though the usual pattern on most existing machines is the AS.12. These wire-guided weapons are steered by the co-pilot using the XM-58 gyro-stabilized sight system. Clearly the obsolescent missile will soon be replaced by AB.212ASW operators with a more modern weapon. This helicopter can also serve in the role of stand-off guidance platform for anti-ship missiles fired by other friendly launchers, in particular the ship-fired Otomat 2 cruise missile. In this role the helicopter is fitted with the search radar and a TG-2 real-time target data transmission system.

Specification
AB.212ASW

Type: multi-role helicopter for shipboard operation

Powerplant: one 1,875-shp (1398-kW) Pratt & Whitney Canada T400 (PT6T-6) Turbo Twin Pac with two gas-turbine power sections

Armament: two Mk 46 AS torpedoes, or two depth charges or two anti-ship missiles (typically AS.12)

Performance: maximum speed 196 km/h (122 mph); cruising speed 185 km/h (115 mph); search endurance 3 hours 12 minutes; maximum range with auxiliary tanks (no reserve) 667 km (414 miles)

Weights: empty 3420 kg (7,540 lb); maximum 5070 kg (11,176 lb);

Dimensions: main rotor diameter 14.63 m (48 ft 0 in); length overall 17.40 m (57 ft 1 in); height 4.53 m (14 ft 10¼ in); main rotor disc area 173.9 m^2 (1,872.0 sq ft)

ITALY/UK

EH Industries EH 101

The most powerful helicopter ever designed in Western Europe, the **EH 101** has its genesis in an SKR (Sea King Replacement) study by the British MoD (Navy) in 1977. Westland responded with a proposal designated WG.34, but meanwhile the Italian navy had come up with a similar requirement, though one with the accent on shore basing rather than operations from warships. Westland and Agusta decided to collaborate, formed EHI (Elicotteri Helicopter Industries Ltd) and, with extreme care and underpinned by much research, drew up the design for the EH 101 as the next-generation helicopter for the British and Italian navies. The same basic machine is also being developed as a civil passenger and utility cargo transport whose engines, rotor systems, airframe and main systems are common with those of the naval variant. The latter is very like a scaled-down CH-53E in configuration, though the three engines are arranged symmetrically around the main rotor. The main cabin is 6.5 m (21 ft 4 in) long, 2.5 m (8 ft 2½ in) wide and, allowing for interior soundproofing, 1.82 m (5 ft 11½ in) high, all dimensions exactly tailored to the missions, as are the folded dimensions for easy shipboard stowage. The maritime roles for which the EH 101 has been designed are ASW, anti-ship surveillance, anti-surface vessel strike, amphibious operations, SAR, AEW and vertrep (vertical replenishment). An unusual feature is that, despite the striking differences between these missions (for example, between cargo vertrep, ASW, and AEW with a giant radar) all role changes can be carried out on board ship. The main five-blade rotor has composite blades with extended-chord tips of the BERP type as fitted to the latest Lynx and Westland 30, while the tail carries a four-blade rotor and can be power-folded, like the main rotor blades, for reduced overall dimensions. Use of three engines confers outstanding safety for flight at maximum weight in all weathers, and General Electric expect the same basic engine to mature at powers some 50 per cent greater than that given in the specification. First flight has been set for early 1985, with production machines following in 1988. The EH 101 has been specified as equipment for the Royal Navy Type 23 frigates, and it is expected to replace the Sea King all over the world.

Specification
EH 101 Naval

Type: multi-role maritime helicopter
Powerplant: three 1,600-shp (1198-kW) General Electric T700-401 turboshafts
Armament: enclosed weapons bay able to accommodate wide range of torpedoes (Marconi Stingray for RN version) and other stores; total disposable load 6085 kg (13,411 lb)
Performance: maximum cruising speed 278 km/h (173 mph); endurance at distant station with full weapon load (dunking ASW role) 5 hours
Weights: maximum take-off 13000 kg (28,660 lb)
Dimensions: main rotor diameter 18.59 m (61 ft 0 in); length overall 22.90 m (75 ft 1½ in), and folded 15.85 m (52 ft 0 in); height 6.50 m (21 ft 4 in); main rotor disc area 271.72 m^2 (2,925.0 sq ft)

UK

Westland Wasp

Though its development can be traced back to the **Saro P.531**, flown in 1958, the **Westland Wasp HAS.Mk 1** emerged in October 1962 as a highly specialized machine for flying useful missions from small ships, such as frigates and destroyers with limited deck pad area. The missions were ASW (anti-submarine warfare) and general utility, but the Wasp was not sufficiently powerful to carry a full kit of ASW sensors as well as weapons, and thus in this role relies on the sensors of its parent vessel and other friendly naval forces, which tell it where to drop its homing torpedoes. In the anti-surface vessel role the Wasp is autonomous, and though it has no radar it can steer the AS.12 wire-guided missile under visual conditions over ranges up to 8 km (5 miles). Other duties include SAR (search and rescue), liaison, VIP ferrying, casualty evacuation with two internally carried stretchers, ice reconnaissance and photography/survey. The cockpit is quite well equipped for bad-weather operation with auto-stabilization, radar altimeter, beacon receivers, UHF radio and UHF homer, and in RN service limited EW provisions. The stalky quadricycle landing gear has wheels that castor so that, while the machine can be rotated on deck, it cannot roll in any direction even in a rough sea. Sprag (locking) brakes are fitted to arrest all movement. Provision was made for various hauldown systems such as Beartrap to facilitate alighting on small pads in severe weather. Deliveries to the Royal Navy began in 1963, and a few were active in Operation 'Corporate' in the South Atlantic right at the end of their active lives when most had been replaced in RN service by the Lynx. Wasp HAS.Mk 1s operated from eight ships in that campaign, all assigned to RN No. 829 Squadron. They flew almost 1,000 hours in 912 combat sorties during which they made no fewer than 3,627 deck landings. Most were used in reconnaissance and utility missions, though several operated in the casevac role. Three, two from HMS *Endurance* and one from the frigate HMS *Plymouth*, engaged the Argentine submarine *Santa Fe* and holed its conning tower with AS.12 missiles which passed clean through before exploding. Other Wasps serve with the Royal Australian, Brazilian and South African navies.

Specification
Type: light multi-role ship-based helicopter
Powerplant: one 710-shp (529-kW) Rolls-Royce Nimbus 503 turboshaft
Armament: two Mk 44 AS torpedoes or two AS.12 anti-ship missiles
Performance: maximum speed with weapons 193 km/h (120 mph); cruising speed 177 km/h (110 mph); range 435 km (270 miles)
Weights: empty 1566 kg (3,452 lb); maximum take-off 2495 kg (5,500 lb)
Dimensions: main rotor diameter 9.83 m (32 ft 3 in); length overall 12.29 m (40 ft 4 in); height 3.56 m (11 ft 8 in); main rotor disc area 75.90 m^2 (816.86 sq ft)

The Westland Wasp took a long time to see action. In service with the Royal Navy for nearly 20 years, Wasps were very active during the Falklands war, just in the twilight of their careers.

ROYAL NAVY
465
ROYAL NAVY

UK

Westland Wessex

The **Westland Wessex** is an excellent helicopter very quickly derived by Westland from the American Sikorsky S-58, to replace the all-British Bristol 192 as the Royal Navy's first dedicated ASW helicopter. The original version was the **Wessex HAS.Mk 1**, powered by a Napier (today Rolls-Royce) Gazelle of 1,450 shp (1081 kW), and this was supplanted by the **Wessex HAS.Mk 3** version popularly called the Camel because of its humpbacked search radar above the rear fuselage. These ASW versions had almost been replaced by Sea Kings at the start of Operation 'Corporate' in April 1982, just two being sent to the war zone, XM837 aboard HMS *Glasgow* and XP142 aboard *Antrim*, both assigned to No. 737 Squadron. The latter caught the Argentine submarine *Santa Fe* and crippled it with depth charges and machine-gun fire; the helicopter returned to the UK peppered with splinter holes and was retired to the FAA Museum. Its sister was the last aircraft lost to enemy action when, on 12 June, it was destroyed by a shore-fired Exocet which passed through its hangar. Much more important numerically is the **Wessex HU.Mk 5** version, the Royal Marine Commando assault version, to which the specification refers. These twin-engine machines once numbered almost 100. Virtually all those in the active inventory accompanied the Task Force, No. 845 Squadron aboard RFAs (Royal Fleet Auxiliaries) and other ships being backed up by two new squadrons (nos 847 and 848) hurriedly formed from second-line units and stored Wessexes. The latter lost half its aircraft aboard *Atlantic Conveyor*, so most of the action fell to No. 847 Squadron, one of whose Wessex HU.Mk 5s knocked out the Argentine HQ in the Port Stanley police station using a newly installed AS.12 missile. Another important operator of the maritime Wessex is the Royal Australian Navy, which still has 10 **Wessex HAS.Mk 31B** (basically similar to the Wessex HAS.Mk 3) helicopters, usually based at Nowra, having previously been embarked aboard HMAS *Melbourne*. Another nine are in storage. They operate chiefly in the SAR role, and like their British counterparts have been progressively updated with improved avionics and role equipment. Their place was taken in the ASW role by the Sea King Mk 50. Other Wessex are used by Brunei, Ghana and Iraq, though not in maritime roles.

Specification
Wessex HU.Mk 5

Type: commando assault helicopter
Powerplant: one Rolls-Royce Coupled Gnome twin-turboshaft with two power sections each rated at 1,350 shp (1007 kW), but with combined output limited to 1,550 shp (1156 kW)
Armament: role kit can include two 7.62-mm (0.3-in) GPMGs firing ahead, one or two 20-mm cannon, two or four AS.11 wire-guided missiles, or rocket pods
Performance: maximum speed 214 km/h (133 mph); cruising speed 195 km/h (121 mph); range 769 km (478 miles)
Weights: empty 3927 kg (8,657 lb); maximum take-off 6120 kg (13,500 lb)
Dimensions: main rotor diameter 17.07 m (56 ft 0 in); length overall 20.03 m (65 ft 9 in); height 4.93 m (16 ft 2 in); main rotor disc area 228.81 m^2 (2,463.0 sq ft)

Helicopters in the South Atlantic

The Falklands war saw naval helicopters operating in virtually all their prescribed missions. Under the stress of battle, and flying in some of the most hostile environments on Earth, the Royal Navy machines flew well beyond the call of duty.

A Sea King HC.Mk 4 rescues an Army Gazelle AH.Mk 1. Sea Kings were the workhorses in all aspects of the Falklands war, shifting stores from ship to ship, offloading men, kit and supplies to the battlefields, providing casualty evacuation and giving their usual anti-submarine protection.

The British forces captured a number of Argentine helicopters during the assault, one most notable example being this Agusta-Bell 212, bearing Red Cross ambulance markings. Having painted out the markings the British forces promptly used the helicopter themselves.

In the recovery of the Falkland Islands during May and June 1982 the United Kingdom relied heavily upon helicopters for ASW, anti-ship attack and, in a small degree, armed close support on land against local point targets. In addition, helicopters did virtually all the basic 'trucking' between ships, the beach-heads and the forces on the islands, including front-line supply of all necessities and the evacuation of casualties. Helicopters were also important to the Argentine army and other forces, but only in a transport role.

Right at the very start of the conflict, Argentina lost an Aérospatiale SA 330 Puma and an Aérospatiale Alouette III on 3 April during the invasion of the Falklands dependency of South Georgia. This sizable island, some 800 miles (1290 km) to the south east, was defended by a small unit of Royal Marines, who managed to bring down both helicopters with small-arms fire. It was at the same place that the next helicopter action took place, in late April. The first British forces to reach the war zone had come from Gibraltar, and on 21 April two Westland Wessex HU.Mk 5s and an anti-submarine Wessex HAS.Mk 3 landed on Fortuna Glacier on South Georgia, but both Wessex HU.Mk 5s crashed during a blind take-off in a blizzard on the following day. Fortunately the 'camel' humped Wessex HAS.Mk 3 made it, and it returned to rescue the crews of the other machines. Two days later, on 25 April, the same Wessex HAS.Mk 3 was launched from the cruiser *Antrim* to follow up a plot of a submerged submarine off Grytviken Harbour; this submarine was the first ever to be destroyed by helicopter action. Details of the encounter are given elsewhere in this feature.

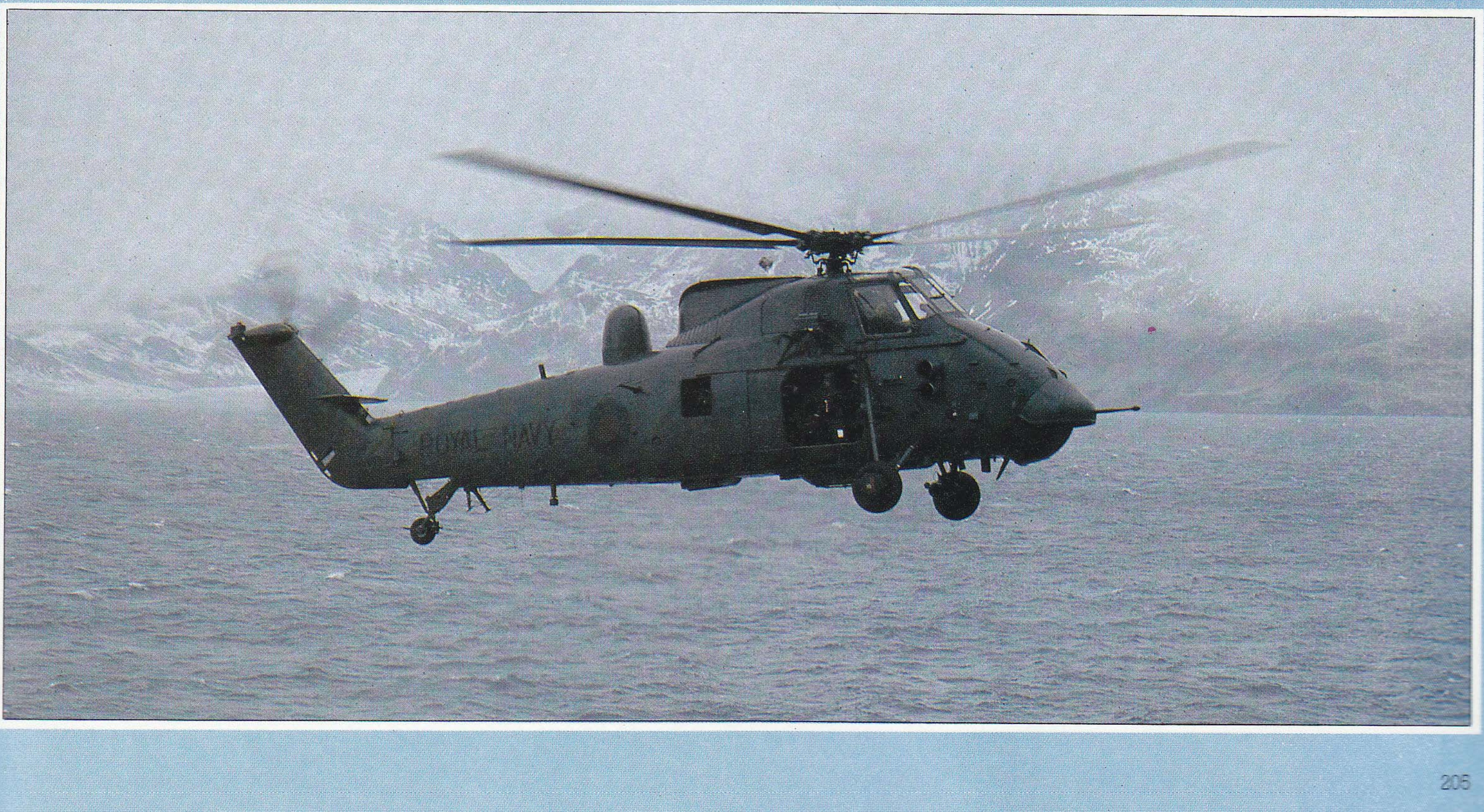
Pitch-black battle

The next major helicopter action was on the night of 2-3 May. The UK had declared a TEZ (Total Exclusion Zone) around the Falkland Islands, and few Argentinian ships dared to enter it. Two which did were the patrol ships *Alferez Sobral* and *Comodoro Somellera*, 800-tonners transferred from the US Navy in 1972. At about 04.00 on 3 May both opened fire on a Sea King on ASW barrier patrol. It was a pitch-black night, and had they kept quiet the ships might never have been detected. The Sea King called up two Lynx HAS.Mk 2s of No. 815 Sqn. Each was armed with two of the brand-new BAe Sea Skua missiles, which technically had not yet completed their acceptance trials. Lynxes can carry four of these missiles, but in the South Atlantic it was common to carry only two in order to extend combat radius and endurance. Each helicopter engaged one ship, having little difficulty in detecting the target on the Lynx's Seaspray radar and then releasing its two rounds with a brief separation in time so that each could individually home on the radar waves reflected from the target. All four rounds were direct hits. *Somellera* immediately vanished, while *Sobral* had its bridge and most of the other superstructure blown away and ceased to be a threat.

Eclipsed by Exocet

Later in the campaign three other Sea Skuas were fired, all these likewise scoring direct hits. All seven warheads exploded, and the performance of this new missile throughout the campaign was flawless. It is curious that it gained virtually no publicity in the media, whereas the Aérospatiale AM.39 Exocet gained tremendous worldwide notoriety for its accomplishments in the Falklands notwithstanding the fact that of the two Exocets which struck British warships neither exploded. It is also strange that the average man is convinced that the Exocet was the first sea-skimming missile to be used in war, whereas in fact the first was the Sea Skua. It is also worth noting that all the ships engaged by the seven Sea Skuas

Conditions in the South Atlantic were treacherous for the ships, but they were almost suicidal for the helicopters. Nonetheless they soldiered on, operating way beyond all the prescribed limits.



Royal Navy Sea Kings approach dangerously close to the burning assault ship Sir Galahad, *rescuing men in the sea and using downwash from their rotors to drive liferafts away from the stricken vessel.*

were in general less than 25 ft (8 m) to the top of their superstructure, and the freeboard over substantial parts of their length was no more than 8 ft (2.4 m), which confirms the low height at which Sea Skua can reliably cruise even in heavy seas.

Sea King patrols

Little has been said about the often boring but nevertheless vital task of ASW patrol flown by the Royal Navy Sea Kings. The chief units involved were No. 820 Sqn, with Sea King HAS.Mk 5s (distinguished by the enlarged flat-topped radome) of which nine were embarked in HMS *Invincible*, and No. 826 Sqn, again with the Sea King HAS.Mk 5, with nine embarked in *Hermes*, the Task Force flagship. The older Sea King HAS.Mk 2 was used by No. 824 Sqn, operating from Royal Fleet Auxiliaries *Olmeda* and *Fort Grange*, and by No. 825 Sqn whose machines were based on *Atlantic Causeway* and *Queen Elizabeth 2*. Other ASW machines were the 'camel' Wessexes of No. 737 Sqn aboard the cruisers HMS *Antrim* and *Glamorgan*, the Lynxes of No. 815 Sqn and the Wasps of No. 829 Sqn, which were based on various ships.

Argentinian submarines were clearly a potentially serious menace, especially the two quite new German-built Type 209s which are small, fast and quiet, and thus could have operated in shallow water and proved extremely hard to detect. From the time it left Ascension on 16 April the Task Force maintained a ceaseless ASW patrol, and this was maintained for three months until well after the Argentinian surrender. There were nothing like enough ships or aircraft for a tight and total blockade, and it was expected that submarines would make effective attacks and cause losses to the Task Force. In fact, no ships were struck by torpedoes, though there is evidence that as many as four were fired and possibly detonated against decoys.

There were certainly numerous possible contacts, though the consensus is that the majority were probably not submarines but whales. Incidentally, four of the Sea King HAS.Mk 5s of No. 826 Sqn were already fitted for evaluation with the ASQ-81(V) MAD 'bird', similar to that carried by the US Navy Sikorsky SH-3H Sea King, and installed in an almost identical fairing to the rear of the right-hand main-gear float. This was for an evaluation which began before the invasion of the islands, and it is understood that the MAD operated reliably (though there was not much for it to detect).

Land-based units

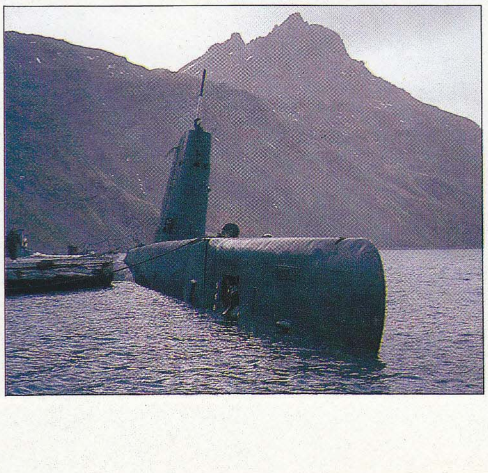
The chief British land-based armed helicopter unit was No. 3 Commando Brigade (Royal Marines) Air Squadron, normally based at Bickleigh. Both its Aérospatiale Gazelles and its Westland Scouts carried rocket pods, and many had GPMGs and other weapons. A little later the Army Air Corps got into action with the same two types deployed by No. 656 Sqn, from Netheravon. Before leaving the UK all the Gazelles were modified by REME No. 70 Aircraft Workshop at Middle Wallop (AAC HQ) with folding blades, IFF transponders, armour, radio altimeters, flares, pods for 68-mm (2.68-in) SNEB ground-attack rockets, and smoke

The Attack on the *Santa Fe*

A crewman's first-hand account of the attack on the Argentine submarine ARA **Santa Fe.**

On the afternoon of 24 April 1982 during the Falkland Islands war, intelligence was received on board HMS *Antrim*, the ship commanding the South Georgia Task Group, which indicated that the Argentinian submarine ARA (Armada Republica Argentina) *Santa Fe* might be in the South Georgia area. The commander of the Task Group, Captain B. G. Young ADC RN (subsequently DSO), ordered all ships – except HMS *Endurance* which was conducting separate operations in Hound Bay – to retire to the north east at 200 nautical miles in order to re-assess the situation. Further reports, indicating that the *Santa Fé* might attempt to enter Grytviken during the night of 24-25 April, were received so it was decided to close the island again to a range of 50 nm and to launch *Antrim*'s Wessex HAS.Mk 3 helicopter on a surface search at first light on 25 April. Also, a Lynx from HMS *Brilliant*, which had joined the Task Group on 14 April to supplement depleted air assets as a result of the loss of two Wessex HU.Mk 5s which were lost on special operations on Fortuna Glacier, was tasked to conduct a surface search covering the coast towards Bird Island (to the north west), armed with a Mk 46 torpedo. HMS *Plymouth*'s Wasp helicopter was placed on stand-by armed with AS.12 missiles.

At 08.10 on 25 April *Antrim*'s Wessex, crewed by Lieutenant Commander Ian Stanley (1st pilot), Sub Lieutenant Stewart Cooper (2nd pilot), Lieutenant Chris Parry (Observer) and Petty Officer Aircrewman David Fitzgerald (Sonar Operator) launched and transitted 50 nm towards the mouth of Cumberland Bay. Visibility was less than 0.5 nm, the wind was 310° at 15 kts, and cloud cover consisted of full cover at 400 ft and broken stratus at 1000 ft. A totally radio-silent transit was made and the area around Cumberland Bay was searched visually. One single sweep on the Wessex radar showed a tiny contact consistent with that of a submarine periscope at 08.55 bearing 350° from Barff Point at the mouth of the bay. The Wessex closed to investigate and at 0.5 nm the contact was visually identified as an Argentinian 'Guppy III' class submarine. The submarine was headed into sea, with no one immediately visible on the fin, and obviously preparing to dive. It was immediately attacked by *Antrim*'s Wessex using air-launched depth charges which exploded very close to the after port casing. After some violent careering the submarine turned hard to port and headed towards Grytviken, with oil and smoke streaming from the after casing (hull). *Plymouth* was requested to launch her Wasp and *Brilliant*'s Lynx was called in to deliver her torpedo if the submarine showed any sign of diving. But the *Santa Fe* showed little ability to dive. *Brilliant*'s Lynx, however, came under machine-gun fire from the submarine. The torpedo was released, with nil result, and the machine-gun fire was returned until the arrival of *Plymouth*'s Wasp, which was meanwhile speeding in from 40 miles. On arrival, the Wasp fired two AS.12 missiles to prevent further gunfire attacks, or worse, from the submarine. *Endurance* announced that her Wasps (two) would be airborne shortly to deliver an AS.12 attack. *Endurance*'s Wasps subsequently achieved hits on the submarine fin (conning tower) which did little damage as they punched through the GRP (Glass Reinforced Plastic) fin before exploding. The submarine was subsequently abandoned alongside the British Antarctic Survey jetty in Grytviken harbour.



The wreck of the Argentine submarine lies off the jetty at Grytviken, having had its war career ended by attack from a combination of Royal Navy helicopters.

South Georgia assault

After a hurried conference, the Task Group Commander decided to go ahead with the assault on South Georgia. At 14.45 *Antrim*'s Wessex HAS.Mk 3 led *Brilliant*'s two Lynxes to land troops on the shore opposite Grytviken. Shore bombardment was now carried out on the ground around Grytviken by *Antrim* and *Plymouth*. It took an hour to land the troops using the three helos. Later that day *Antrim*'s Wessex flew two more trips in support of the operation, one as an airborne communications link and another to take *Antrim*'s Medical Officer ashore to attend to an Argentinian casualty (the only one of the operation so far), a sailor who had been manning the machine-gun in the submarine's fin. He had to have his leg amputated as a result of an AS.12 missile hit.

dispensers to form emergency smokescreens. Rocket practice was put in at Ascension, by which time many Gazelles and Scouts had locally installed GPMG mounts and upturned exhausts to reduce IR signature. The Gazelle shot down on 6 June is believed to have been hit by radar-directed ground fire.

One of the constant tasks of RM and AAC helicopters was tactical reconnaissance, and here the optical sight of most Scouts was crucial. Though by no means the newest such equipment, the Avimo AF.120, fitted in the cabin roof of Scouts equipped with AS.11 missiles, is fully stabilized and offers up to ×10 magnification. The sights were in constant use, and on many occasions were used to help guide AS.11s against particular point targets. One Scout was shot down by an FMA IA 58 Pucará on 28 May near Goose Green.

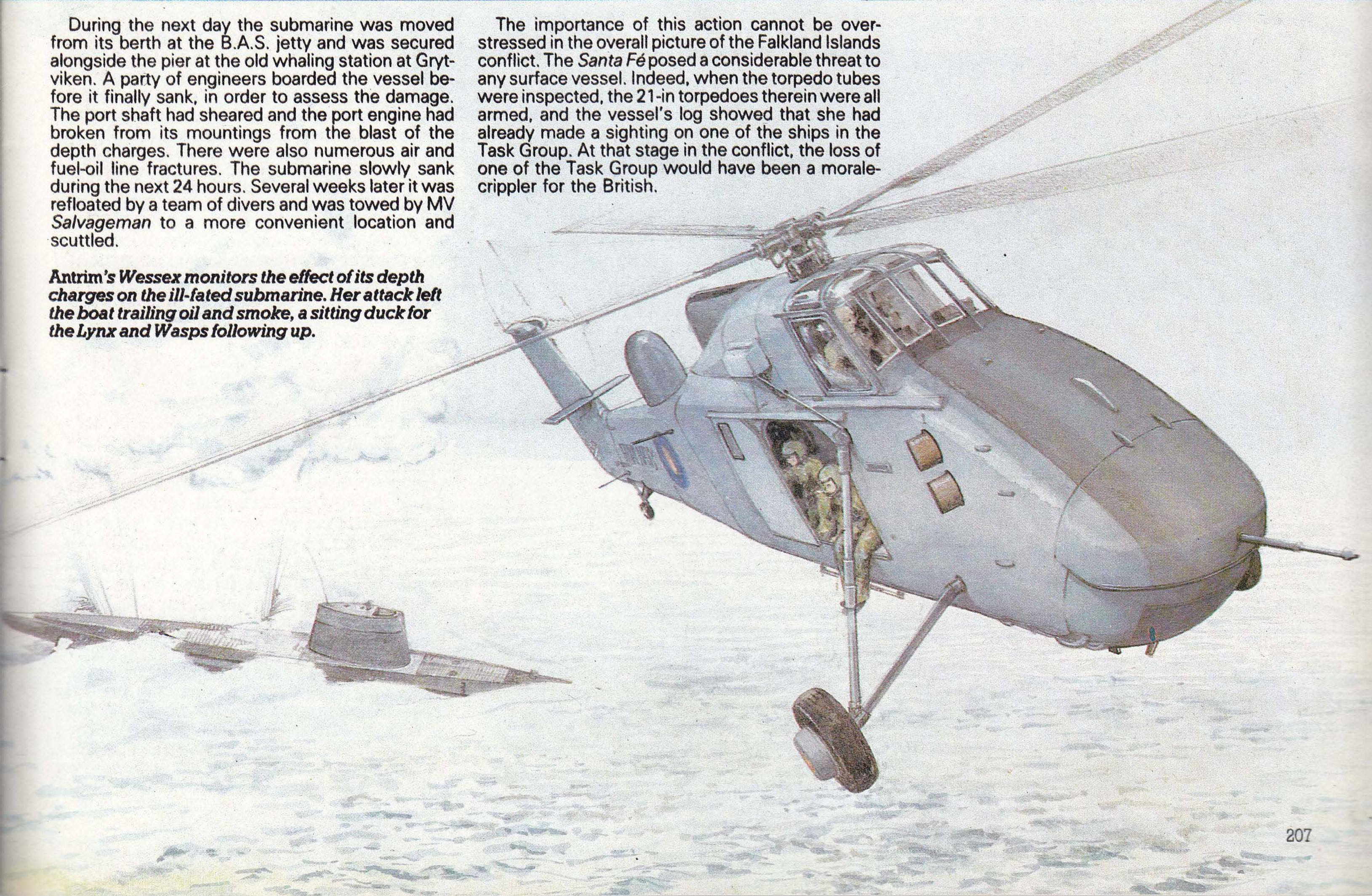
A little publicized but dangerous task carried out by many Sea Kings was acting as decoys to try to lure sea-skimming missiles away from surface ships. When possible this was combined with ASW patrol. To increase their effective radar cross-section the helicopters dumped large clouds of chaff.

Task Force Westland Lynx arrives to pick up more stores from HMS Invincible while a Sea King HAS.Mk 2 stands by, prior to its next mission – possibly anti-submarine protection of the fleet.

So far as is known the Argentinian forces did not use helicopters in an offensive role, though the nine Agusta A 109As were fitted with rocket-launchers and gun pods. Several of the Bell UH-1H Iroquois helicopters had M60 and other gun mounts, but they were little used.

During the next day the submarine was moved from its berth at the B.A.S. jetty and was secured alongside the pier at the old whaling station at Grytviken. A party of engineers boarded the vessel before it finally sank, in order to assess the damage. The port shaft had sheared and the port engine had broken from its mountings from the blast of the depth charges. There were also numerous air and fuel-oil line fractures. The submarine slowly sank during the next 24 hours. Several weeks later it was refloated by a team of divers and was towed by MV *Salvageman* to a more convenient location and scuttled.

The importance of this action cannot be overstressed in the overall picture of the Falkland Islands conflict. The *Santa Fé* posed a considerable threat to any surface vessel. Indeed, when the torpedo tubes were inspected, the 21-in torpedoes therein were all armed, and the vessel's log showed that she had already made a sighting on one of the ships in the Task Group. At that stage in the conflict, the loss of one of the Task Group would have been a morale-crippler for the British.



Antrim's Wessex monitors the effect of its depth charges on the ill-fated submarine. Her attack left the boat trailing oil and smoke, a sitting duck for the Lynx and Wasps following up.

UK

Westland Sea King

In 1959, the year in which the Sikorsky S-61 helicopter first flew, Westland of the UK concluded a licence agreement, and the company developed the **Westland Sea King HAS.Mk 1** as the new ASW (anti-submarine warfare) helicopter of the Royal Navy, delivering 56 in 1969-72. Compared with the US Navy HSS-2 (SH-3), the Sea King HAS.Mk 1 has equipment for completely autonomous operation with no help from the parent warship, including AW 391 dorsal radar, Plessey Type 195 dunking sonar and a fully fitted tactical compartment for managing a whole ASW operation. These machines have been modified to **Sea King HAS.Mk 2** standard with more powerful Rolls-Royce Gnome engines and improved equipment, 21 Sea King HAS.Mk 2 helicopters also being built new. The **Sea King HAS.Mk 3** is the RAF search-and-rescue model with very complete equipment and great versatility (SAR models carry up to 22 rescuees including stretcher casualties). The **Sea King HC.Mk 4** is the version of the Command for the Royal Navy (used for Royal Marine assault transport) with the shipboard features (such as folding blades and tail) but simple fixed landing gear and fitted for 27 troops or 6,000 lb (2722 kg) of cargo. The **Sea King HAS.Mk 5** is the current RN ASW model, with dramatically uprated avionics, all Sea King HAS.Mk 2s being converted to this standard; 17 were built new and after the Falklands (when Sea Kings flew almost non-stop in terrible weather) nine more were ordered. The Royal Navy is currently receiving a small number of **Sea King AEW** helicopters in response to a need appreciated in the Falklands war of 1982. This model has Thorn-EMI Searchwater radar with its antenna in an inflated and swivelling radome projecting from the right side of the fuselage. Key items in the Sea King HAS.Mk 5's avionics suite are the MEL Sea Searcher surveillance radar with a radome of considerably different shape and size, provision for the launch of passive sonobuoys, LAPADS (Lightweight Acoustic Processing and Display System) by Marconi for the quicker and more precise handling of acoustic data, and a better display system. To permit the installation of the extra equipment, the cabin has been extended aft by 1.83 m (6 ft). Westland have exported ASW and SAR Sea Kings (including the upgraded **Sea King Mk 50** with Bendix sonar for Australia) to eight countries. The **Commando**, which first flew on 12 September 1973, is a tactical transport similar to the Sea King HC.Mk 4.

Specification

Type: ASW and multi-role helicopter

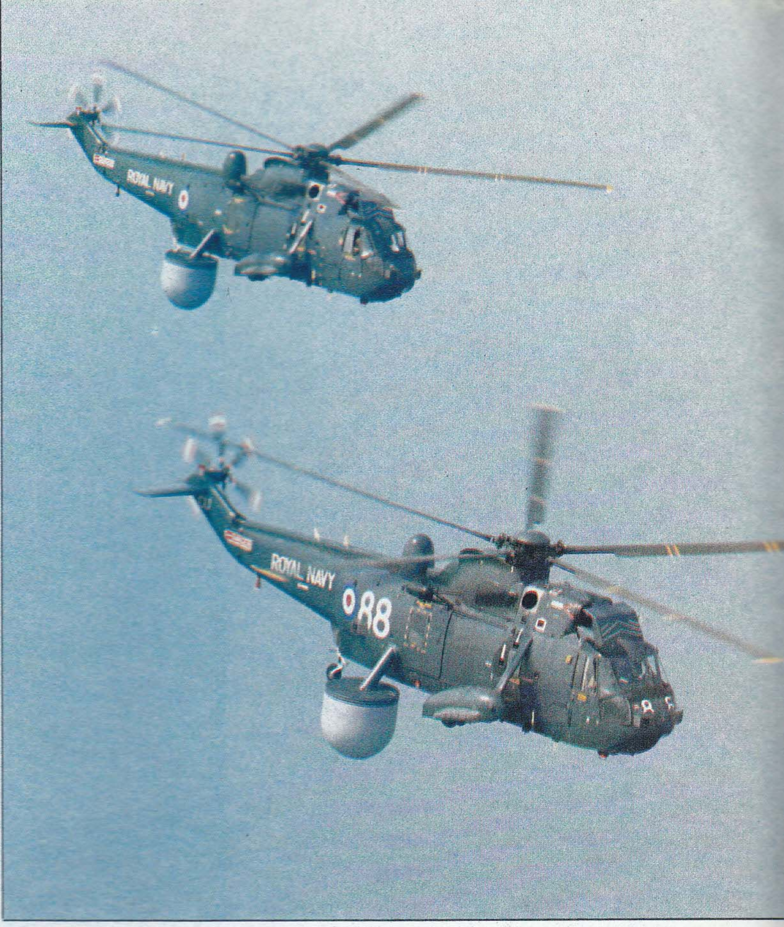
Armament: extremely comprehensive ASW sensors and systems plus up to four Mk 46 torpedoes or Mk 11 depth charges

Powerplant: two 1,660-shp (1238-kW) Rolls-Royce Gnome H.1400-1 turboshafts

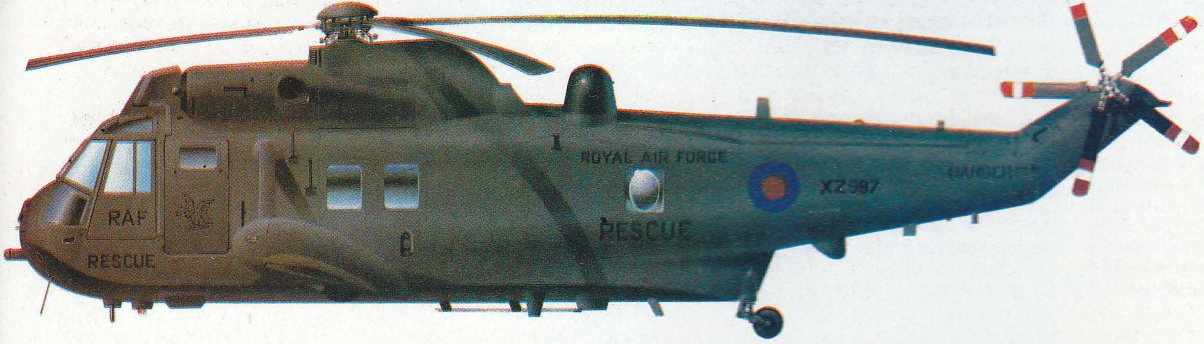
Performance: cruising speed at maximum weight 208 km/h (129 mph); range on standard fuel 1230 km (764 miles)

Weights: empty 6201 kg (13,672 lb); maximum take-off 9525 kg (21,000 lb)

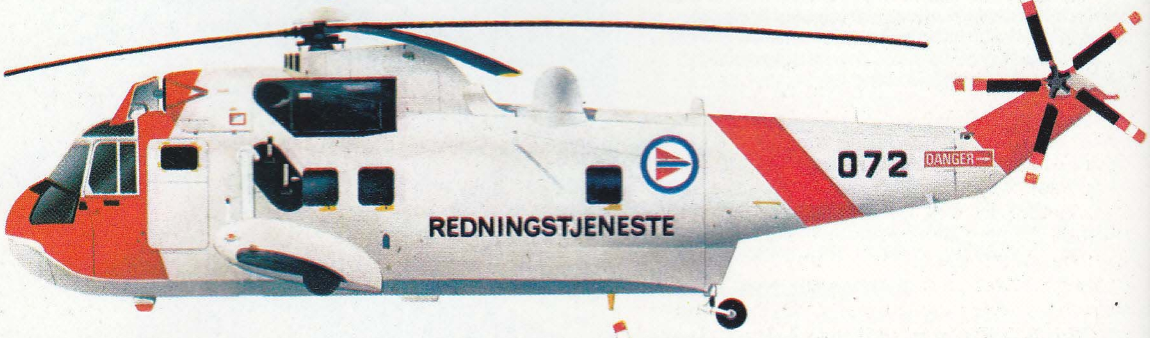
Dimensions: main rotor diameter 18.9 m (62 ft 0 in); fuselage length 17.01 m (55 ft 9¾ in); height 5.13 m (16 ft 10 in); main rotor disc area 280.5 m^2 (3,019.1 sq ft)



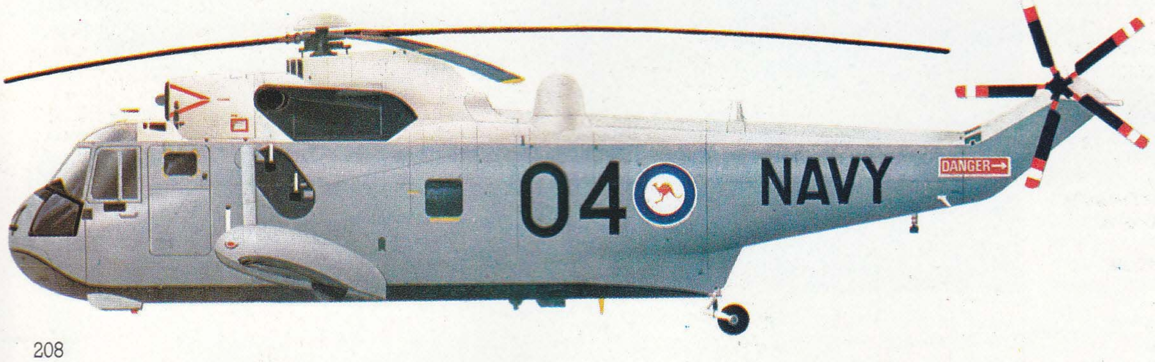
Above: Following the Falklands conflict, Westland Sea King HAS.Mk 2s and HAR.Mk 3s were hastily converted to the AEW role by the addition of Thorn-EMI Searchwater radar in rotating 'kettledrums' on the side of the fuselage.



Left: Known as the 'Grey Whales', the Sea King HAR.Mk 3 detachment from No. 202 Sqn RAF based at Port Stanley in the Falklands has provided sterling service in the SAR role, whilst also giving much help with transport duties around the islands and surrounding ocean.



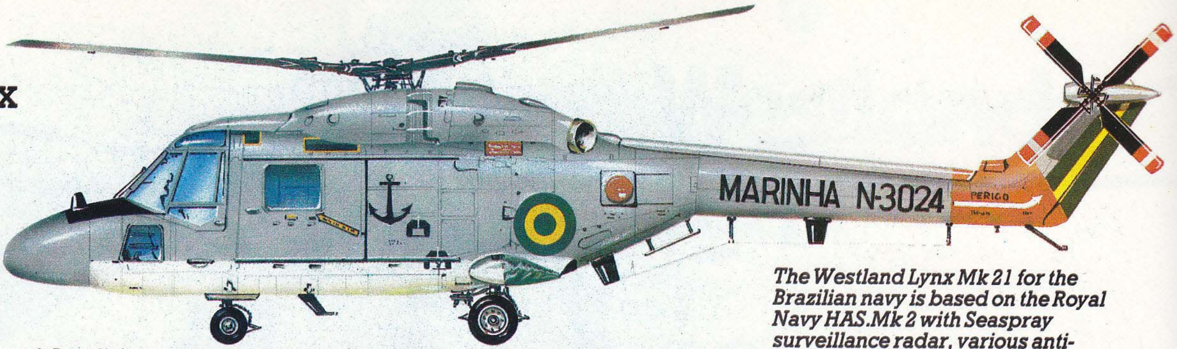
Right: Another operator of the SAR (search and rescue) Westland Sea King is the Norwegian air force, which has 11 of this Mk 43 version serving with No. 330 Sqn. Pairs are detached around the coast but home base is Bodö. Westland also supplied an uprated Sea King Mk 42A.



Left: The Westland Sea King Mk 50 is the standard anti-submarine helicopter of the Royal Australian Navy's Fleet Air Arm group serving with HS-817 squadron. The Mk 50 improved on earlier models and led to the HAS.Mk 2 for the Royal Navy.

UK

Westland Lynx



The Westland Lynx Mk 21 for the Brazilian navy is based on the Royal Navy HAS.Mk 2 with Seaspray surveillance radar, various anti-submarine devices and Sea Skua anti-ship missiles.

On technical grounds the **Westland Lynx** is the best medium shipboard helicopter in the world, and from the original **WG.13** concept which formed part of the Anglo-French helicopter agreement of 1967 has been derived a series of uprated versions which not only bring in additional missions but also greatly enhanced capabilities. Though all are similar in terms of overall dimensions, the later versions have increased power for operation at greater weights, and the recent development of upgraded models of **Westland 30** (the large-fuselage variant) has opened the way to machines which completely equal the mission capability of the Sikorsky SH-60B but in a smaller and more compact helicopter. The original naval model, the **Lynx HAS.Mk 2** for the Royal Navy, was actually the first production variant to fly, in February 1976. Powered by two 750-shp (559-kW) Gem 2 engines, this has a gross weight of 4309 kg (9,500 lb), yet carries a crew of two (three in the ASW or SAR roles) plus all equipment for a wide range of shipboard missions including ASW, SAR, ASV (anti-surface vessel) search and strike, reconnaissance, troop transport (typically 10 troops), fire support, communication and fleet liaison and vertrep (vertical replenishment) duties. Equipment of all these models includes a search radar which in the 60 Lynx HAS.Mk 2s of the RN is the Ferranti Seaspray; the equivalent machines of the French Aéronavale have the OMERA-Segid ORB 31W. In the ASW search role other sensors can include Bendix or Alcatel dipping sonars or a TI MAD (magnetic anomaly detector). The basic Lynx has one of the world's most advanced flight-control systems which, in conjunction with very comprehensive navaids, makes possible precision flying in even the worst weather, as was amply proved during over 3,000 hours of combat operations off the Falklands in 1982. During this campaign the new Sea Skua anti-ship missile was also brought into action for the first time. Though other missiles can be carried, the Sea Skua is the most effective in the world for this mission, and up to four can be fired and guided automatically by radar homing even in conditions of zero visibility. In 1979 the Royal Netherlands navy began receiving the upgraded **Lynx Mk 27**, first of a Mk 2 family with Gem 41-1 engines and weights ranging from 4763 to 4990 kg (10,500 to 11,000 lb). The most recent batches for the RN and Aéronavale are of this new standard which offers greater capability. **Lynx 3** development to 5443 kg (12,000 lb) has been completed, and Lynx 4 will take the weight to 6577 kg (14,500 lb) using a five-blade rotor.

Specification

Lynx HAS.Mk 2

Type: multi-role shipboard helicopter

Powerplant: two 750/900-shp (559/671-kW) Rolls-Royce Gem 2 turboshafts

Armament: two Mk 44, Mk 46 or Sting Ray homing AS torpedoes, or four BAe Sea Skua anti-ship missiles, or two Mk 11 depth charges, in each case with full mission equipment

Performance: maximum cruising speed 232 km/h (144 mph); time on ASW hover at 93 km (58 miles) 2 hours; ferry range 1046 km (650 miles)

Weights: empty 2740 kg (6,040 lb); maximum take-off (early machines) 4309 kg (9,500 lb) or (later machines) 4763 kg (10,500 lb)

Dimensions: main rotor diameter 12.80 m (42 ft 0 in); length overall 15.16 m (49 ft 9 in); height 3.60 m (11 ft 9¾ in); main rotor disc area 128.71 m^2 (1,385.4 sq ft)

Lynx in Action

Packed with new technology and advanced design features, the Lynx has swiftly become the world's leading naval light multi-role helicopter. It has already seen action and now serves with eight naval air arms.

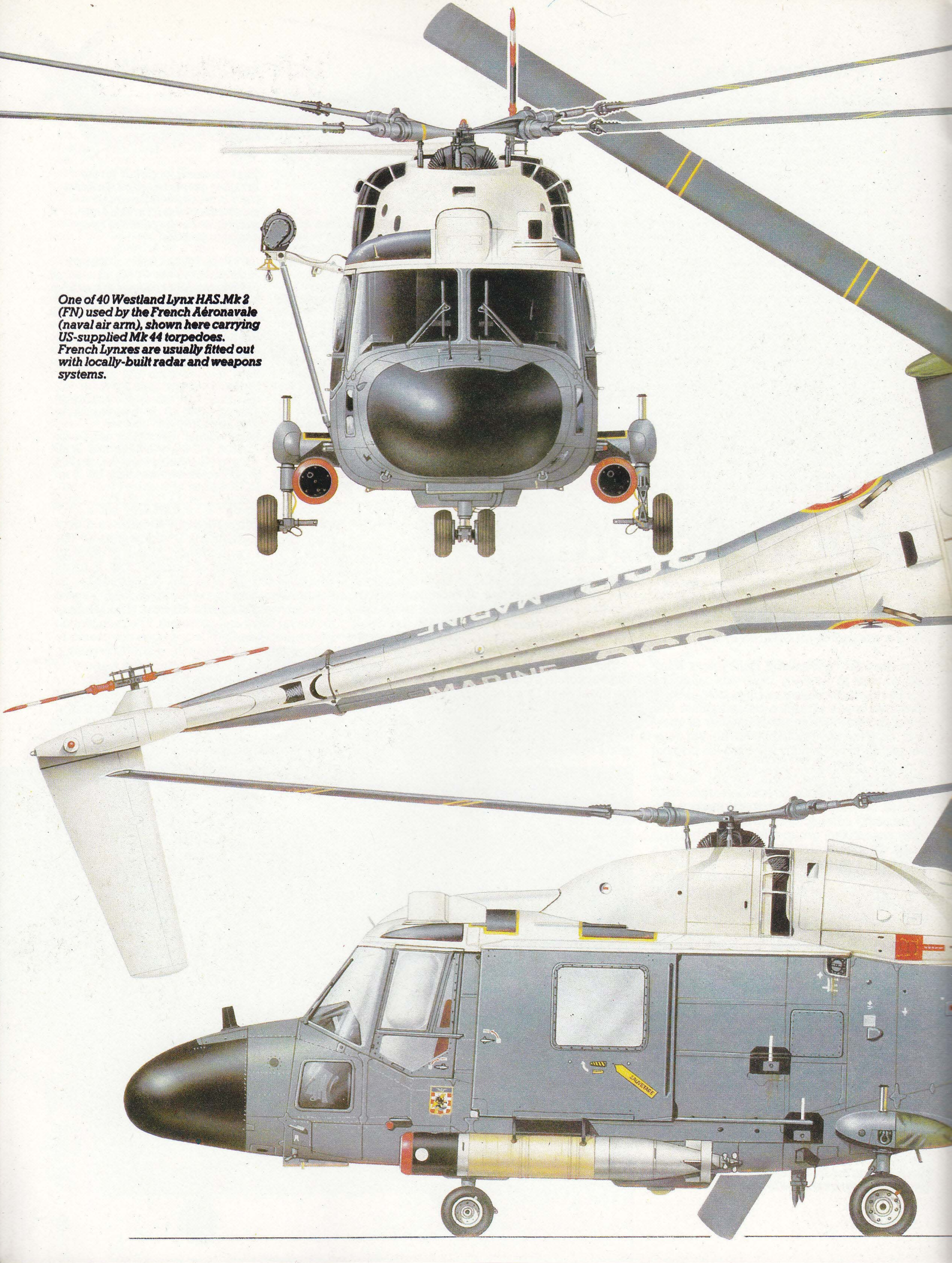
From the start of Westland Helicopters' planning for what in the early 1960s was called the WG.13 (the name Lynx coming later), every effort was made to find a basic formula that would appeal to the greatest number of operators, both military (including naval) and commercial. New technology enabled the original Lynx, first flown on 21 March 1971, to be the most modern in the world, typical features being the all-new Rolls-Royce Gem three-shaft engines, the conformal-gear main gearbox giving amazing compactness (with a much shallower powerplant group above the cabin than in rival designs) and the four-blade rotor with a semi-rigid hub forged from a single slab of titanium. This hub is one of the parts made in France by Aérospatiale, which was brought in at the start of the project under the terms of the 1967 Anglo-French helicopter programme.

So successful was the Westland design staff in attaining its objectives that the Lynx has already been developed in a succession of improved families, each characterized by greater power and increased gross weight, with army, navy and large-fuselage commercial variants within each group. Moreover, the performance of the original naval model in the conflict in the South Atlantic in the second quarter of 1982 surpassed that of any other new helicopter, with essentially 100 per cent availability despite blizzard conditions and a flying rate approximately three times the normal peacetime level. Included in these operations was the first combat use of the new Sea Skua anti-ship missile, which (unlike the more mature AM.39 Exocet fired against the Task Force) worked as advertised on every occasion, scoring seven direct hits with seven shots.

The naval Lynx was in fact the first production version to fly, the first Lynx HAS.Mk 2 for the Royal Navy flying on 10 February 1976. This model was characterized by wheeled landing gear, with a castoring and steerable (±90°) twin-wheel nose unit and single-wheel main gears which can be toed out 27° to the sides for stability on pitching decks. Painted in 'midnight blue', the Lynx HAS.Mk 2 is powered by the Gem 2 with contingency rating of 900 shp (671 kW) and entered service with a gross weight of 4309 kg (9,500 lb). Subsequently this has been increased to 4423 kg (9,750 lb), and it is at this weight that the 60 Lynx HAS.Mk 2s of the Royal Navy are operating. The designation Helicopter Anti-Submarine does not preclude many other missions, such as anti-ship missile attack, all forms of rescue and a variety of liaison, surveillance and transport duties.

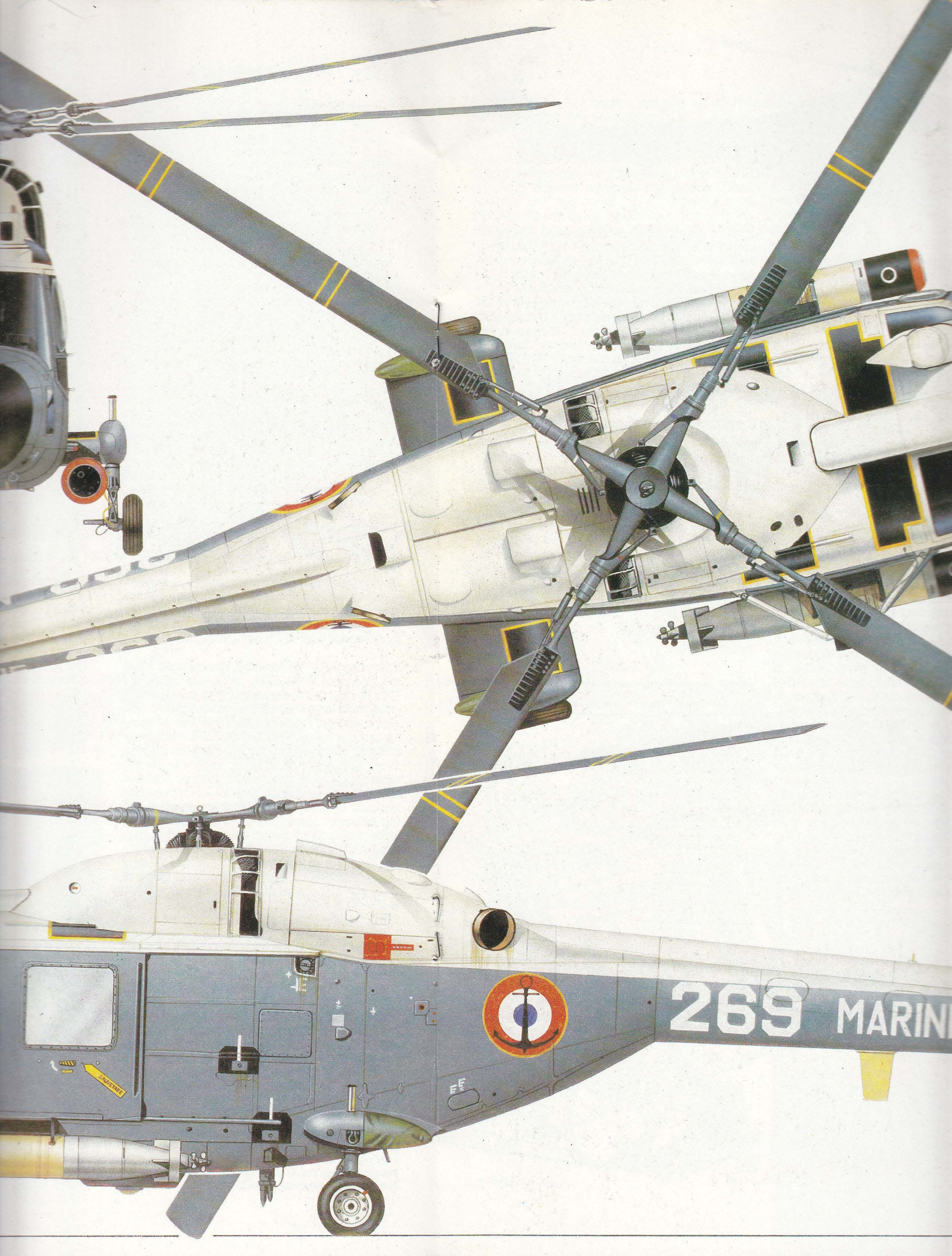
One of the original equipment items was the Ferranti Seaspray radar, specially designed for overwater operations. Though small and compact this radar has outstanding performance in conditions of poor visibility and high

One of the most important combinations of missile and helicopter in the Western world is the Lynx and Sea Skua. These have proved deadly, particularly in the South Atlantic, and this has sparked new interest in the Lynx.



One of 40 Westland Lynx HAS.Mk 2 (FN) used by the French Aéronavale (naval air arm), shown here carrying US-supplied Mk 44 torpedoes. French Lynxes are usually fitted out with locally-built radar and weapons systems.

MARINE
MARINE
SAUVETAGE



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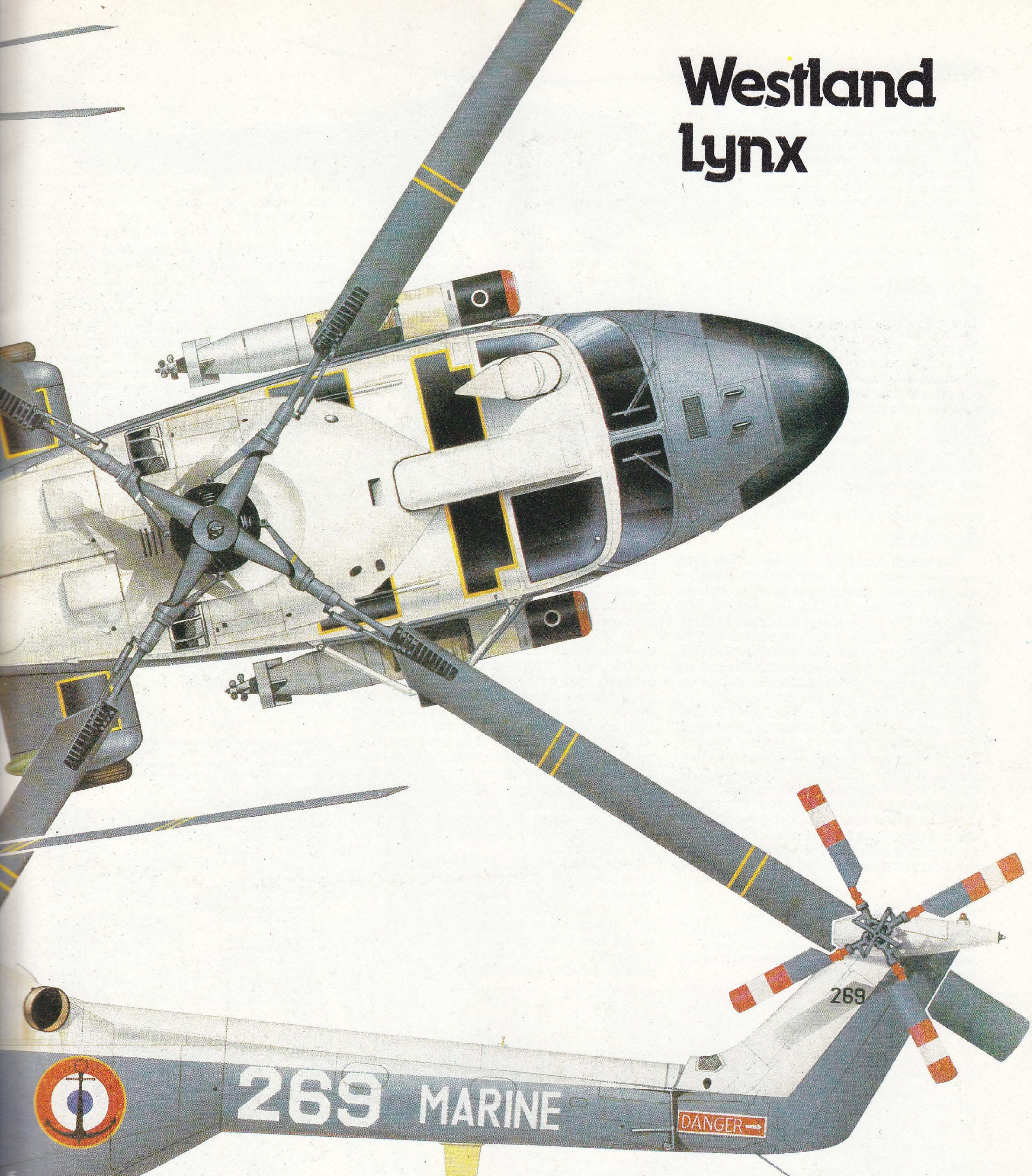
Westland Lynx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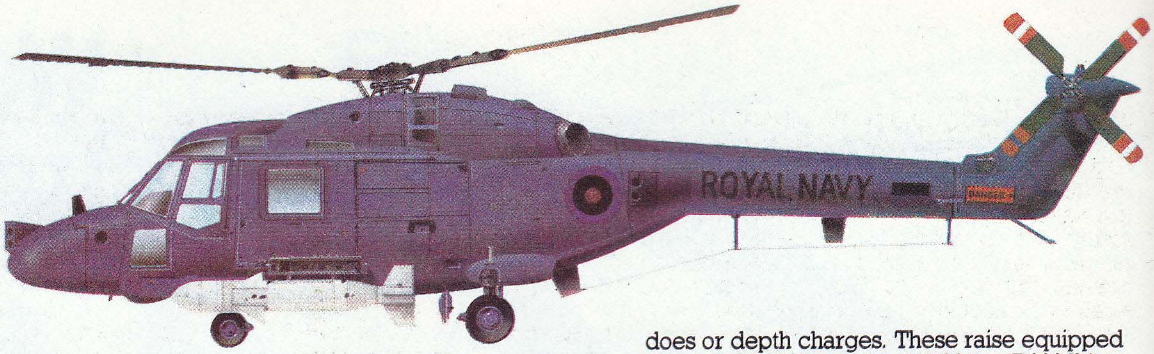
269 MARINE
DANGER

Lynx in Action

A Sea Skua-equipped Lynx HAS.Mk 2 of the Royal Navy in the toned-down colour scheme used in the South Atlantic. The nose-mounted unit is for ESM (Electronic Support Measures), a term used to describe surveillance, intelligence and secure transmissions.



sea state, and has repeatedly demonstrated its ability in blizzard conditions to detect small targets such as the tips of periscopes or snort masts. It is a frequency agile set, with operating frequency which can hop automatically in a random manner to defeat enemy ECM. (A variant is the Blue Fox radar fitted to the Sea Harrier.) This occupies the broad nose radome, and a post-delivery modification of RN Lynxes is the addition of Racal-Decca MIR-2 (Orange Crop) passive warning ESM in the upper part of the nose, the solid-state wide-band aerial system being housed in a prominent box above the nose and serving the advanced digital receiver with LED (light-emitting diode) cockpit display.

Quick kit fit

The British Aerospace Dynamics Sea Skua anti-ship missile is a very modern weapon, which was still undergoing its acceptance trials in April 1982 when the Task Force sailed. The Lynx HAS.Mk 2 was a very important helicopter with that force, being deployed aboard both HMS *Hermes* and HMS *Invincible* with No. 815 Squadron and with detached flights carried aboard virtually all the surface warships including the five Type 42s, six Type 21s, two Type 22s and four older ships of the 'Leander' class. In the final hours before the force sailed Westland Helicopters evaluated a forward-firing 20-mm gun installation but rejected this in favour of a kit enabling a 7.62-mm (0.3-in) GPMG to be aimed by a crew-member from the main door. Westland supplied 14 sets of this kit. Nine sets of MAD (magnetic-anomaly detection) gear were also supplied, four of which were quickly installed. The Lynx MAD installation is similar to that urgently added to Sea King HAS.Mk 5 helicopters, with a Texas Instruments towed 'bird' on the right lower side of the fuselage which for sub-surface search can be let down on some 24 m (80 ft) of transmitting cable. Anti-Exocet jamming pods were also installed.

Sea Skua missiles also accompanied the Task Force. The Lynx was suddenly called into action in the pitch darkness at 02.40 on the morning of 3 May 1982 when Sea Kings were fired at by small Argentinian surface ships. The big machines were on ASW patrol, and they radioed for assistance in removing the Flak menace. Lynxes took off from two Type 42s, HMS *Coventry* and HMS *Glasgow*, and flew at high speed each carrying two Sea Skuas, to the approximate location of the enemy ships. The Seaspray radars 'worked marvellously'; in a matter of minutes all four missiles had been fired and guided by Seaspray to their small targets. The 800-tonne *Somellera* was sunk on the spot, and her sistership *Alferez Sobral* was crippled.

On 16 May Sea Harriers fired their guns at two Argentinian supply ships and one, *Rio Carcarana*, was abandoned by its crew. It was promptly sunk by three Sea Skuas, all of which hit. Sea Skuas, usually in pairs but occasionally four at a time, were commonly carried on the 1,863 combat sorties flown by naval Lynxes in the South Atlantic. Total flight time was 3,042 hours 50 minutes, and the number of deck landings was 4,405. Throughout, the helicopter performed admirably, and showed outstanding reliability. Sadly, three were lost, through no fault of their own, when their ships were destroyed beneath them: HMS *Ardent*, HMS *Coventry* and *Atlantic Conveyor*.

Back in 1979 Westland began delivering the Lynx Mk 27, the first configured for ASW operations, to the Royal Netherlands Navy, with which it is designated SH-14B (previously the UH-14A multi-role search/rescue and trainer model had been supplied). The SH-14B was designed to carry heavier loads, including Alcatel dunking sonar and two homing torpedoes or depth charges. These raise equipped empty weight from about 3266 kg (7,200 lb) to 3650 kg (8,047 lb). Westland accordingly strengthened the transmission and introduced a modified main gearbox in which the third pinion, instead of merely extracting power for the tail rotor, is in fact an input gear through the use of a balancing geartrain. This opened the way to greater input power, and the Gem 41-1 is installed, rated for contingency at 1,120 shp (835 kW). This enabled gross weight to be increased successively to 4536, 4763 and now 4876 kg (10,000, 10,500 and now 10,750 lb).

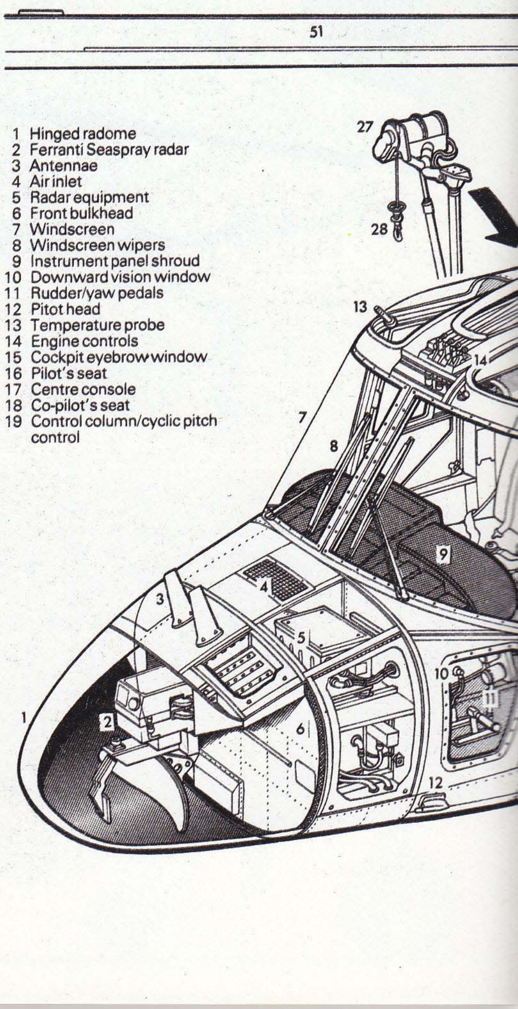
Replacement and reinforcement

Almost all export Lynxes are at this standard, known as Lynx 2 to Westland, and the two original customers are now also receiving uprated Lynx 2 machines, the Royal Navy taking 23 Lynx HAS.Mk 3 (three are replacements for the machines lost off the Falklands), all finished in the new standard medium grey colour, and the French Aéronavale a further 14 Lynx Mk 4 (FN) to add to the original 26 Lynx Mk 2(FN).

The availability of the three-pinion gearbox

A Lynx HAS.Mk 2 shows off its sprightly performance. Its semi-rigid rotor blades enable the aircraft to perform aerobatics, including a fully-developed roll, though this manoeuvre is not permitted by the Royal Navy.

Westland/Aérospatiale Lynx HAS.Mk 2 cutaway drawing key



1	Hinged radome
2	Ferranti Seaspray radar
3	Antennae
4	Air inlet
5	Radar equipment
6	Front bulkhead
7	Windscreen
8	Windscreen wipers
9	Instrument panel shroud
10	Downward vision window
11	Rudder/yaw pedals
12	Pitot head
13	Temperature probe
14	Engine controls
15	Cockpit eyebrow window
16	Pilot's seat
17	Centre console
18	Co-pilot's seat
19	Control column/cyclic pitch control

ROYAL NAVY
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Replacement and reinforcement

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The availability of the three-pinion gearbox and Gem 41-series engine opened the way to what became the Westland 30, with a very large new fuselage making possible an increase in cabin volume from 5.21 m^3 (184 cu ft) to a remarkable 13.03 m^3 (460 cu ft). This led to highly attractive civil 17-seaters and to a new range of military versions, but in turn it has opened the way to the third generation of small-body machines, beginning with the military Lynx 3 but to include various Lynx 3 naval variants. These will have variously the Gem 60, with a contingency rating of 1,346 shp (1004 kW), or the larger General Electric T700 (civil model, CT7) rated at 1,725 shp (1286 kW). These engines, offering roughly twice the power of the original Gem, make possible helicopters no larger than the orig
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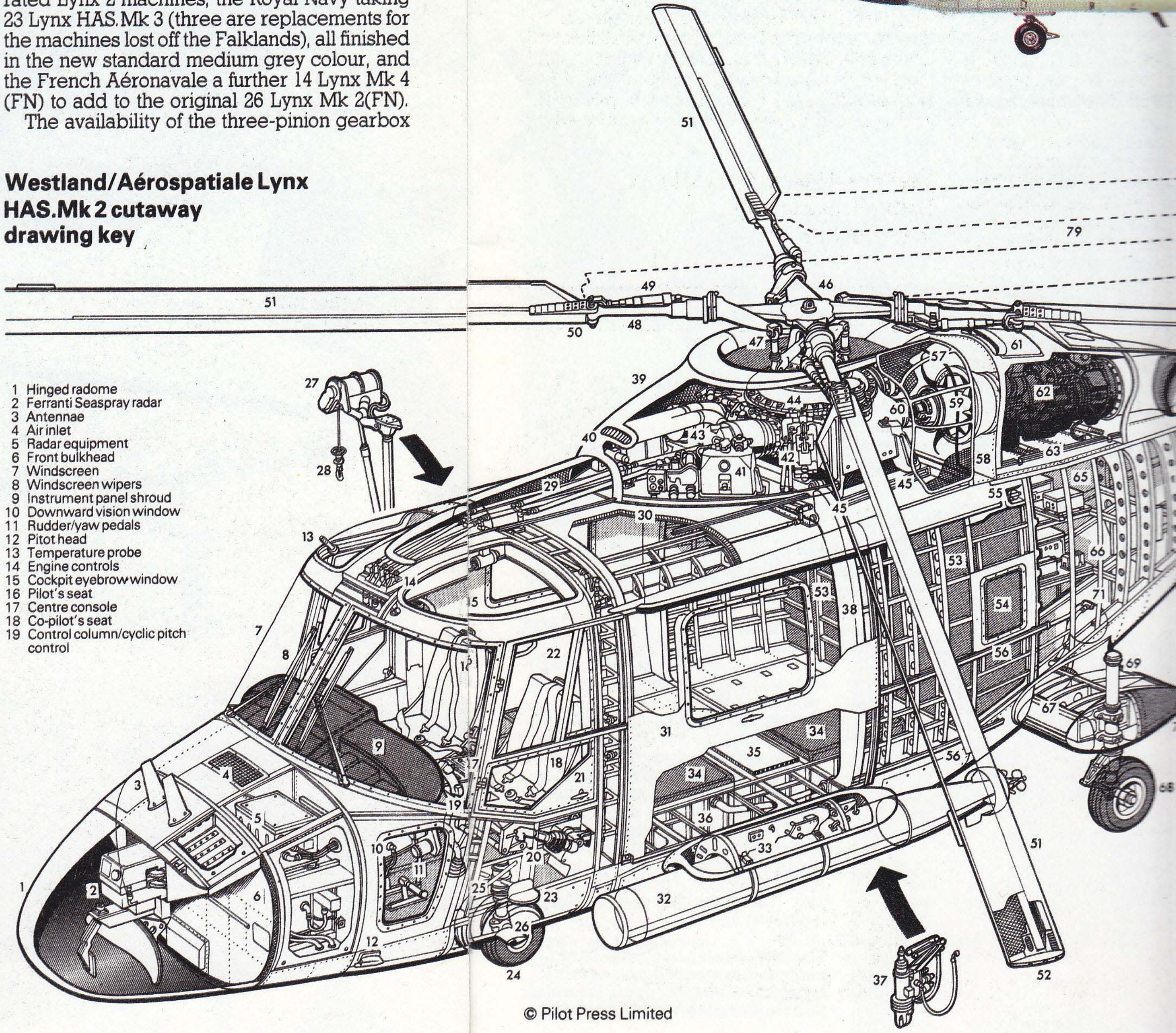
The Netherlands navy uses both this UH-14A utility version and the SH-14B and SH-14C anti-submarine variants.

Westland/Aérospatiale Lynx HAS.Mk 2 cutaway drawing key



1 Hinged radome
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12 Pitot head
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17 Centre console
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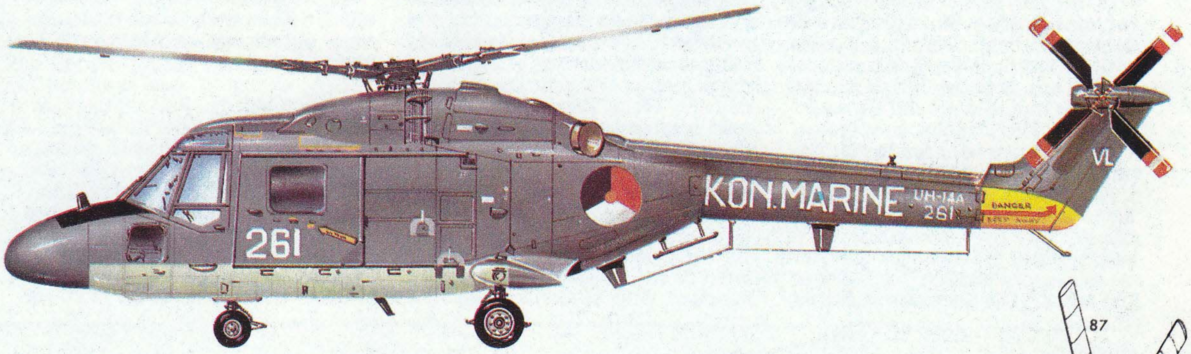
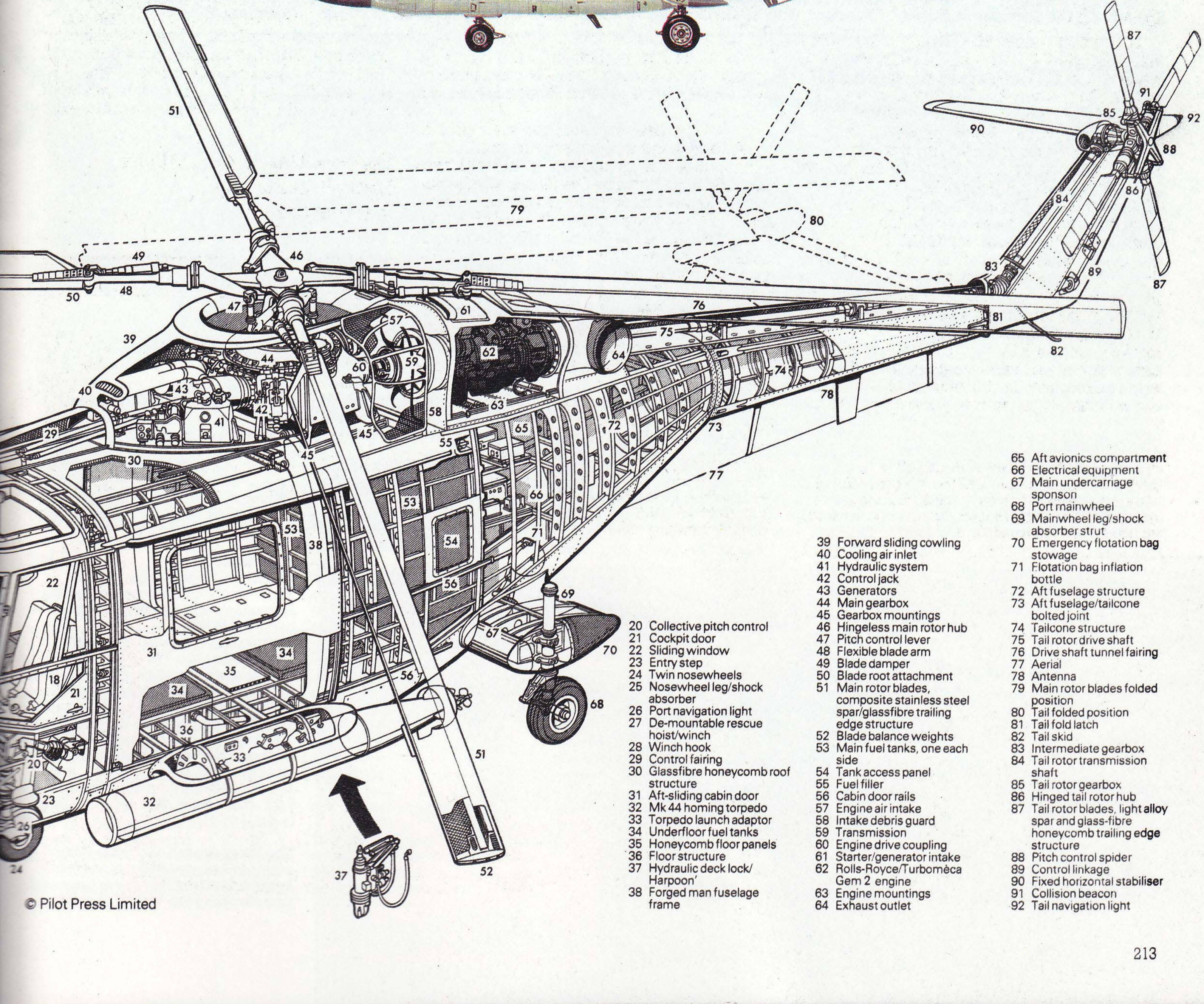
The new standard main rotor to absorb the greater power has four broad composite blades with odd-shaped (BERP, for British Experimental Rotor Programme) tips, which among other things greatly reduce noise and rotor 'slap' heard at great distances. Under the nose the naval Lynx 3 will have 360° panoramic surveillance radar. Deck haul-down, locking and manoeuvring equipment can be to customer order, and the new landing gear provides for increased rates of descent at the new gross weights up to 5806 kg (12,800 lb), with 6577 kg (14,500 lb) anticipated from 1985 with a five-blade main rotor. Dipping sonar and MAD will be normal fits for the ASW mission together with two or even four torpedoes or depth charges. Four or six Sea Skuas could be carried, as well as a wide range of other weapons including ADSM (Stinger) or similar self-defence AAMs.

Thus, because of its inherently good basic design and the availability of progressively more powerful engines, the family of Lynx helicopters cannot fail to grow as new versions and new customers emerge. Essentially the Lynx does the job that cannot be done by any rival design except for machines that are larger and more expensive, such as the Sikorsky S-70 (SH-60B Seahawk) and Aérospatiale AS 332 Super Puma.

The Netherlands navy uses both this UH-14A utility version and the SH-14B and SH-14C anti-submarine variants.





20 Collective pitch control
21 Cockpit door
22 Sliding window
23 Entry step
24 Twin nosewheels
25 Nosewheel leg/shock absorber
26 Port navigation light
27 De-mountable rescue hoist/winch
28 Winch hook
29 Control fairing
30 Glassfibre honeycomb roof structure
31 Aft-sliding cabin door
32 Mk 44 homing torpedo
33 Torpedo launch adaptor
34 Underfloor fuel tanks
35 Honeycomb floor panels
36 Floor structure
37 Hydraulic deck lock/'Harpoon'
38 Forged man fuselage frame
39 Forward sliding cowling
40 Cooling air inlet
41 Hydraulic system
42 Control jack
43 Generators
44 Main gearbox
45 Gearbox mountings
46 Hingeless main rotor hub
47 Pitch control lever
48 Flexible blade arm
49 Blade damper
50 Blade root attachment
51 Main rotor blades, composite stainless steel spar/glassfibre trailing edge structure
52 Blade balance weights
53 Main fuel tanks, one each side
54 Tank access panel
55 Fuel filler
56 Cabin door rails
57 Engine air intake
58 Intake debris guard
59 Transmission
60 Engine drive coupling
61 Starter/generator intake
62 Rolls-Royce/Turboméca Gem 2 engine
63 Engine mountings
64 Exhaust outlet
65 Aft avionics compartment
66 Electrical equipment
67 Main undercarriage sponson
68 Port mainwheel
69 Mainwheel leg/shock absorber strut
70 Emergency flotation bag stowage
71 Flotation bag inflation bottle
72 Aft fuselage structure
73 Aft fuselage/tailcone bolted joint
74 Tailcone structure
75 Tail rotor drive shaft
76 Drive shaft tunnel fairing
77 Aerial
78 Antenna
79 Main rotor blades folded position
80 Tail folded position
81 Tail fold latch
82 Tail skid
83 Intermediate gearbox
84 Tail rotor transmission shaft
85 Tail rotor gearbox
86 Hinged tail rotor hub
87 Tail rotor blades, light alloy spar and glass-fibre honeycomb trailing edge structure
88 Pitch control spider
89 Control linkage
90 Fixed horizontal stabiliser
91 Collision beacon
92 Tail navigation light

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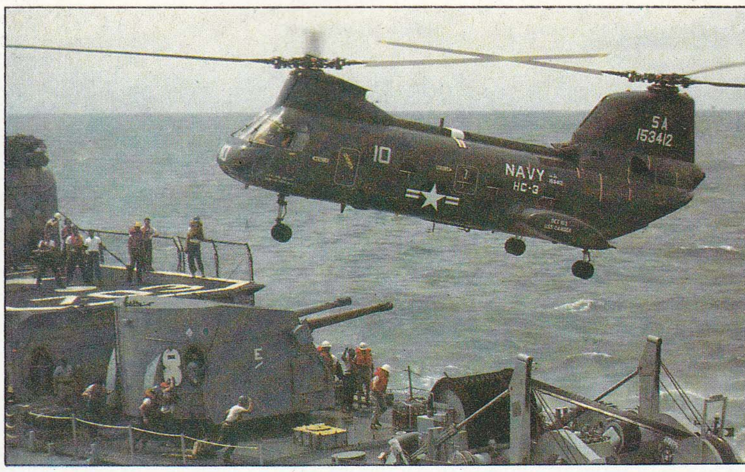
USA/JAPAN

Boeing Vertol 107

First flown on 22 April 1958, the **Boeing Vertol Model 107** twin-turbine tandem-rotor helicopter was built by the company in large numbers as the **H-46** series for the US Navy and US Marine Corps, plus other customers, and the same basic design remains in production in various versions in Japan, as the **Kawasaki KV-107** family. The original production model was ordered in 1961 after winning a US Marine Corps competition for an assault troop transport. This basic model, in service as various forms of **CH-46 Sea Knight,** accommodates a typical total of 26 troops or 15 casualty litters. The US Navy bought the **UH-46** model, with the same accommodation but also able to carry 3175 kg (7,000 lb) of cargo, including vehicles loaded through the full-section rear ramp door, for use in the vertrep (vertical replenishment) of ships at sea. Both Sea Knight families can have rescue hoists and are equipped for limited amphibious operation, though they are not intended for sustained alighting on rough seas. A total of 624 of both models was delivered by 1971, and in recent years most surviving examples have been subjected to major update programmes which include fitting glassfibre rotor blades. The best 273 Sea Knights in US Marine Corps service are progressively being rebuilt as **CH-46E** helicopters with the more powerful engine listed in the data, replacing the 1,250- or 1,400-shp (932- or 1044-kW) T58 engines originally fitted, as well as numerous improvements to improve reliability, rescue capability and ability to survive a crash on land or on water. Since 1981 a total of 368 kits is being supplied to provide further modifications to improve safety and reduce costs. Sweden uses the Gnome-engined **HKP-7** version for ASW and minesweeping duties, while the major licence-production by Kawasaki has resulted in 12 new versions which include several for naval use. Most are long-range SAR (search and rescue) and cargo/troop transports, but the naval **KV-107II-3** is a specialized MCM (mine countermeasures) helicopter, of which nine serve with the JMSDF's 111th Air Wing. This version has uprated engines (1,400 shp/1044 kW) instead of 1,250 shp/932 kW) and comprehensive equipment for minesweeping and retrieval, as well as long-range tanks, cargo hook and towing gear. Another operator is Canada, whose **CH-113** versions are being updated to an improved maritime SAR standard with extra fuel, weather radar, a water dam for use of the rear ramp at sea and an APU (auxiliary power unit).



Workhorse of the US Navy for nearly 20 years, the UH-46 Sea Knight serves as a ship replenishment helicopter. Japan builds the type under licence.

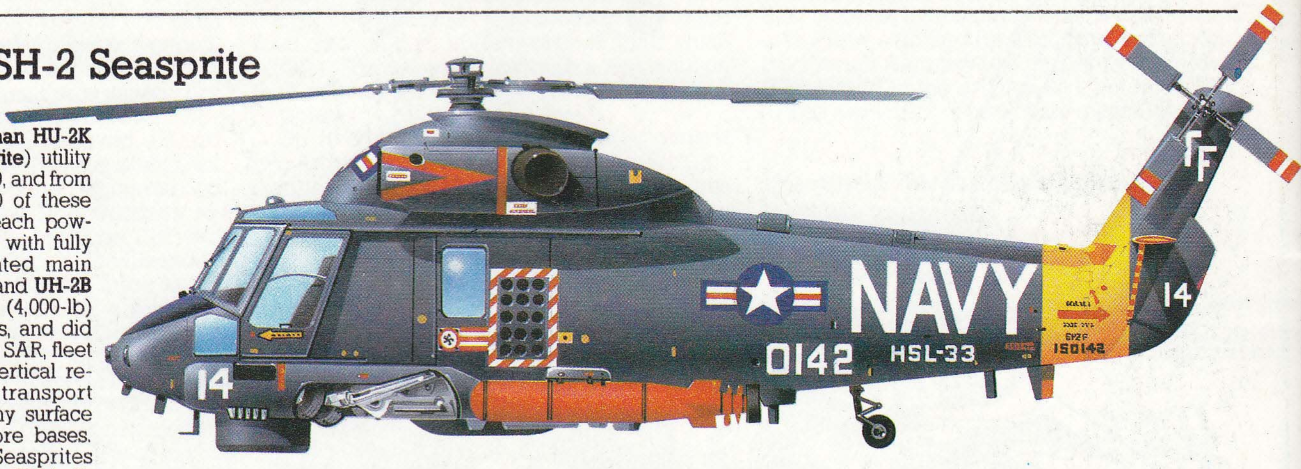
Specification
CH-46E Sea Knight

Type: multi-role transport helicopter
Powerplant: two 1,870-shp (1394-kW) General Electric T58-16 turboshafts
Armament: none in most versions (Sweden uses AS torpedoes)
Performance: maximum speed 267 km/h (166 mph); cruising speed 193 km/h (120 mph); range (3000-kg/6,614-lb payload) 175 km (109 miles)
Weights: empty 5240 kg (11,585 lb); maximum take-off 9706 kg (21,400 lb)
Dimensions: main rotor diameter 15.24 m (50 ft 0 in); length overall 25.70 m (84 ft 4 in); height 5.09 m (16 ft 8½ in); rotor disc area 364.8 m^2 (3,927.0 sq ft)

USA

Kaman SH-2 Seasprite

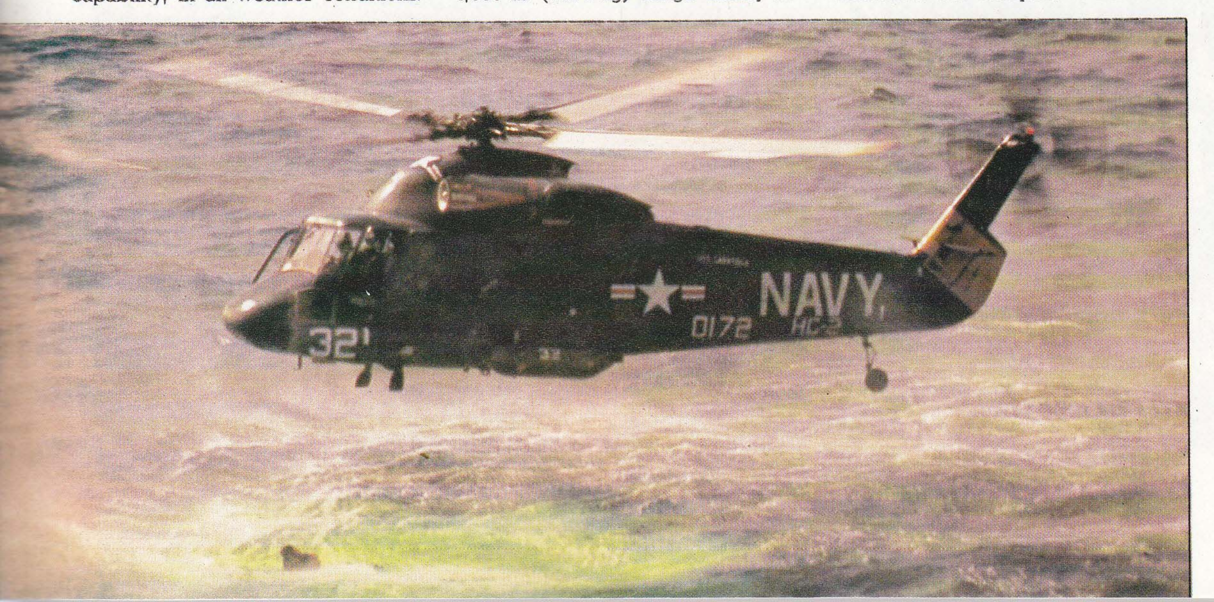
The original prototype **Kaman HU-2K** (later styled **UH-2A Seasprite**) utility helicopter flew on 2 July 1959, and from 1962 Kaman delivered 190 of these very attractive machines each powered by a T58 engine and with fully retractable forward-mounted main landing gears. The **UH-2A** and **UH-2B** could each carry a 1814-kg (4,000-lb) slung load or 11 passengers, and did sterling work in planeguard, SAR, fleet reconnaissance, vertrep (vertical replenishment) and utility transport duties, operating from many surface warships as well as at shore bases. From 1967 all available Seasprites have been converted to twin-T58 helicopters with full engine-out safety and generally improved performance plus better weight-carrying capabilities. Among many other models the most important current variant is the **SH-2F** (Mk 1 LAMPS, for Light Airborne Multi-purpose System) for shipbased ASW and anti-ship missile defence with secondary SAR, observation and utility capability, in all weather conditions. With a crew comprising pilot, co-pilot and sensor operator, the SH-2F can carry full ASW gear including Canadian Marconi LN-66HP surveillance radar, towed 'bird' for the AN/ASQ-18 MAD, AN/ALR-54 passive detection receiver, Difar passive and Dicass active sonobuoys, and comprehensive nav/com and display systems. The 4,000-lb (1814-kg) cargo ability remains, and a 600-lb (272-kg) rescue hoist is standard. From 1973 Kaman not only delivered conversions of earlier models but also 88 new SH-2Fs, followed in 1983-4 by 18 additional machines. The Seasprite LAMPS Mk I is to be supplemented by the Sikorsky SH-60B LAMPS Mk II in the 1980s, but will remain in service throughout the 1990s on the US Navy's older surface vessels.



Anti-submarine warfare is just one of the Seasprite's tasks. The type is a multi-purpose machine, taking in observation, missile defence and general utility work.

Specification
Kaman SH-2F Seasprite

Type: shipboard helicopter (see text)
Armament: one or two AS torpedoes (usually Mk 46)
Powerplant: two 1,350-shp (1007-kW) General Electric T58-8F turboshafts
Performance: maximum speed 265 km/h (165 mph); range with maximum internal fuel 679 km (422 miles)
Weights: empty 3193 kg (7,040 lb); maximum take-off 6033 kg (13,300 lb)
Dimensions: main rotor diameter 13.41 m (44 ft 0 in); fuselage length 12.3 m (40 ft 6 in); height 4.72 m (15 ft 6 in); main rotor disc area 141.25 m^2 (1,521.0 sq ft)



The Seasprite is a neat, ship-based utility and rescue helicopter. Here it has dropped marker dye in the water prior to lifting the 'victim' to safety.

Anti-Ship Helicopters

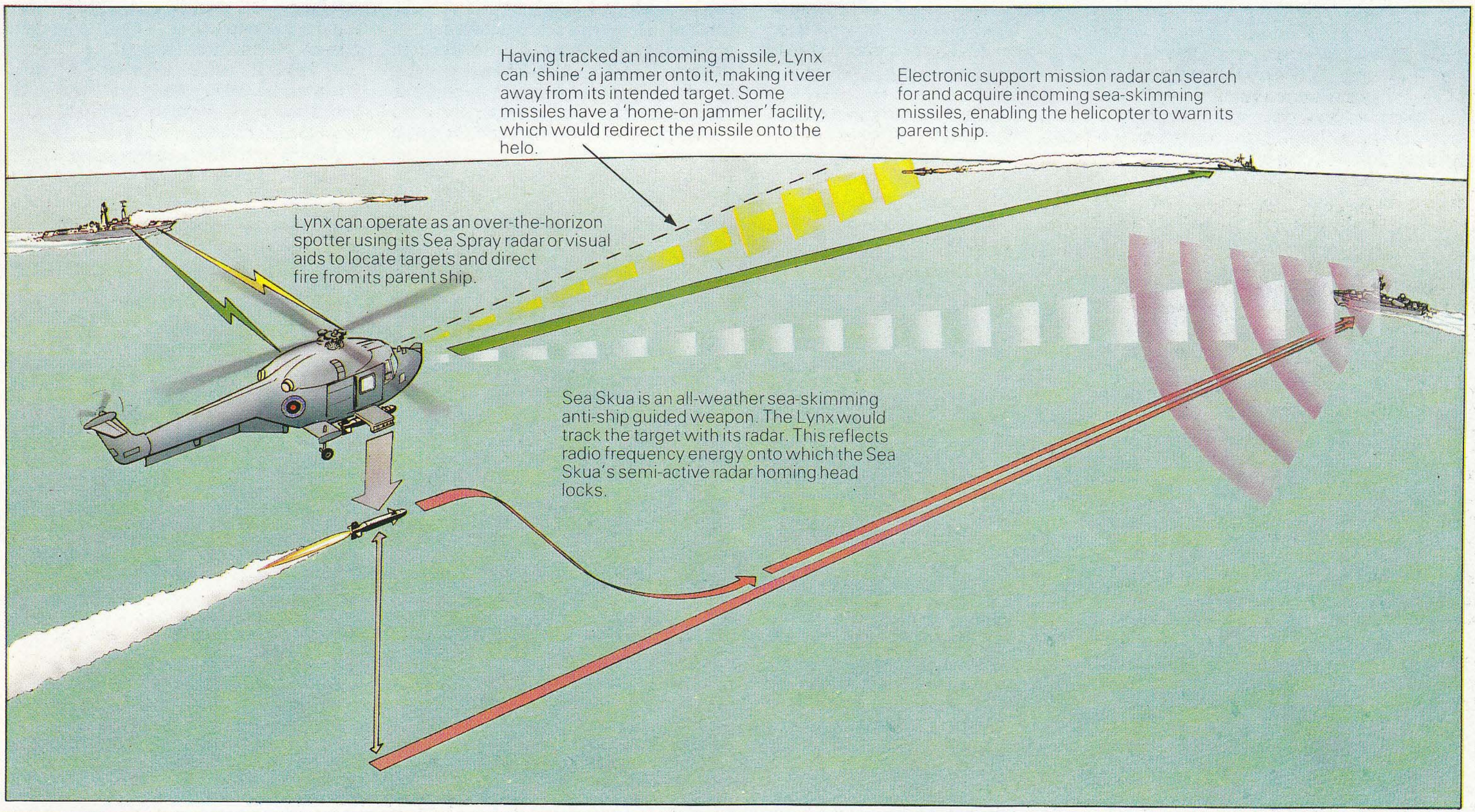
The anti-ship helicopter is as a species relatively young. This is mainly because its principal weapon, the sea-skimming missile, did not exist until after 1960, and did not become effective and common until the late 1970s. Now that the two have been brought together the result is a singularly potent combination which is especially effective against small but important naval vessels such as missile-armed FPBs (fast patrol boats). Helicopters are already widely used for coastal patrol (catching blockade-runners, drug smugglers and the like), and larger machines can carry missiles powerful enough to disable major warships.

Helicopters could have played a significant anti-ship role 30 years ago armed with homing torpedoes. The range of such torpedoes varies greatly, but the perfection of the homing head (initially attracted towards the sound of a ship's propellers) and advanced forms of propulsion (notably electric and high-energy monofuel motors) combined to produce torpedoes with a practical range up to five times the 5 miles (8 km) of typical World War II air-dropped torpedoes. This could have been ample to enable helicopters to make stand-off torpedo attacks beyond the range of ship defences, but the technique was never pursued. Instead the anti-ship helicopter had to wait for the anti-ship missile, which flies just above the ocean surface.

Anti-ship missiles for launch from aeroplanes date from the immediate post-war period, but helicopter-launched versions almost all date from after 1967, when the destruction of an Israeli destroyer by missiles stirred naval staffs from lethargy. Italy's Sistel Marte (Sea Killer 2), France's AM.39 Exocet, the USA's Harpoon, Japan's ASM-1 and Germany's Kormoran date from this period, though the last two have not been adapted for helicopters. Much more recently the British Sea Skua and French AS.15 have triggered off a new family of smaller anti-ship missiles specifically designed for launch from helicopters.

In virtually every case the helicopter or a co-operating aircraft has to use surveillance radar to detect and identify the hostile ship(s). This is one of the weak links in the procedure, in that the helicopter has to be well above the horizon as seen from the ship, and then illuminate the ship with radar signals which trigger the ship's own ESM (electronic support measures) warning systems. The missile is then released towards the target, and under its rocket, turbojet or ramjet propulsion accelerates to high subsonic speed and drops to a very low altitude (typically 33 ft/10 m). Most of its flight is made under self-contained autopilot or inertial guidance; when it is within a few miles of the target the missile activates its own seeker (homing head). Again, this is almost always a radar, which again alerts the ship by illuminating it with radar signals so that the missile can home on the reflections. The ship will probably turn stern-on to reduce its apparent size, and fire clouds of chaff and decoys to try to cause the missile's radar to 'break lock' and instead aim for the chaff or decoys.

Requirements of any ship-based helicopter include small overall size, complete all-weather and night capability, advanced flight-control and autostabilization, and the ability to land on a small steel deck that is pitching and rolling to the extent that most people could not stand upright on it. Various haul-down systems have been developed in which the helicopter lowers a grapnel on a cable to catch a grid on the deck, thus enabling a winch (usually in the helicopter) to pull the machine down with improved security until the wheels touch. Special landing gear is needed, with sprag (pawl/ratchet) locking brakes and wheels that can be locked in offset (castored) positions so that the helicopter cannot roll off the deck into the sea.



Having tracked an incoming missile, Lynx can 'shine' a jammer onto it, making it veer away from its intended target. Some missiles have a 'home-on jammer' facility, which would redirect the missile onto the helo.

Electronic support mission radar can search for and acquire incoming sea-skimming missiles, enabling the helicopter to warn its parent ship.

Lynx can operate as an over-the-horizon spotter using its Sea Spray radar or visual aids to locate targets and direct fire from its parent ship.

Sea Skua is an all-weather sea-skimming anti-ship guided weapon. The Lynx would track the target with its radar. This reflects radio frequency energy onto which the Sea Skua's semi-active radar homing head locks.

USA

Sikorsky S-61/H-3 Sea King

One of the most important helicopter families yet developed, and a mainstay of the Western world's shipborne anti-submarine, forces, the **Sikorsky SH-3 Sea King** series began life as the **HSS-2** anti-submarine helicopter for the US Navy. The prototype of this helicopter first flew on 11 March 1959, and the helicopter, which has the company designation Sikorsky S-61B, was the first which could carry all the sensors and weapons needed for ASW missions without external help (though the US Navy policy has been to regard the aircraft as an extension of the ASW surface vessel from which it operates, so that helicopter-carried sensors detect the hostile submarine before the warship is called in for the 'kill'). New features included an amphibious boat hull with retractable tailwheel landing gear, twin turboshaft engines (for power, lightness, reliability and single-engine flight capability) above the cabin and an unobstructed tactical compartment for two sonar operators whose sensors include a dipping sonobuoy lowered through a keel hatch. Above the extensive avionic systems is an attitude-hold autopilot and a sonar coupler which maintains exact height and station in conjunction with a radar

The reliability and versatility of the SH-3 family have put it at the forefront of naval helicopters since it entered service with the US Navy in 1961.

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Sikorsky S-61/H-3 Sea King (continued)

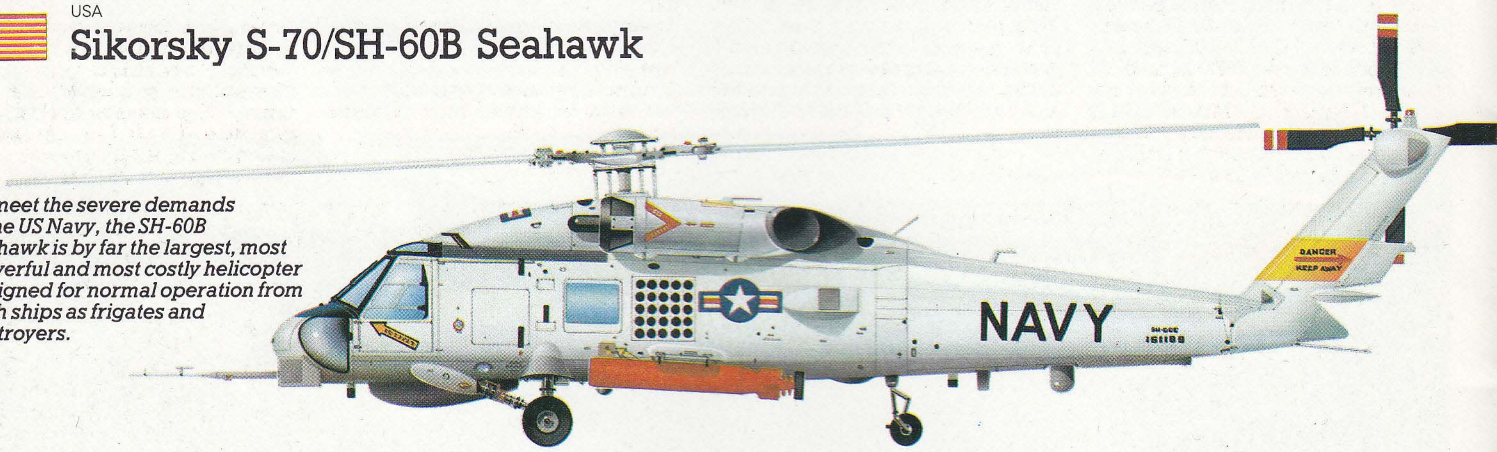
altimeter and Doppler radar. Over 1,100 H-3 type helicopters have been built, the ASW models being SH-3s in four basic models. The **SH-3A** was the original model with 1,250-shp (933-kW) General Electric T58-8B turboshafts, the **SH-3D** is the upgraded version described below; the **SH-3G** is the utility version; and the **SH-3H** is the multi-role model fitted with dipping sonar and MAD gear for ASW and search radar for the detection of incoming anti-ship missiles. Agusta makes versions in Italy, some with Marte anti-ship missile armament, and Westland's Sea King is described separately. The **S-61R**, first flown in 1963, led to a new **CH-3** family of multi-role land-based transports with tricycle landing gear and a rear ramp for loading vehicles or bulky cargo. One model, the **HH-3E** of the USAF Aerospace Rescue and Recovery Service, is famed under the name Jolly Green Giant. It has an inflight-refuelling probe, hoist and much special role gear, and has also been developed into the radar-equipped **HH-3F Pelican** advanced search-and-rescue helicopter for the US Coast Guard. Export models have included the **S-61A** utility transport based on the S-61B, and the **S-61D** anti-submarine model based on the SH-3D. SH-3s are in Canadian service under the designation **CH-124**, and American variants are **RH-3** minesweeping and **VH-3** executive transport helicopters.

Specification
Sikorsky SH-3D Sea King
Type: ASW helicopter
Armament: external hardpoints for total of 381 kg (840 lb) of weapons, normally comprising two Mk 46 torpedoes
Powerplant: two 1,400-shp (1044-kW) General Electric T58-10 turboshafts
Performance: maximum speed 267 km/h (166 mph); range with maximum fuel and 10 per cent reserves 1005 km (625 miles)
Weights: empty 5382 kg (11,865 lb); maximum take-off 9752 kg (21,500 lb)
Dimensions: main rotor diameter 18.9 m (62 ft 0 in); fuselage length 16.69 m (54 ft 9 in); height 5.13 m (16 ft 10 in); main rotor disc area 280.5 m^2 (3,019.1 sq ft)

The highly successful S-61/H-3 Sea King has been built under license by Agusta in Italy. This SH-3D operates primarily in the anti-submarine role.

USA

Sikorsky S-70/SH-60B Seahawk



To meet the severe demands of the US Navy, the SH-60B Seahawk is by far the largest, most powerful and most costly helicopter designed for normal operation from such ships as frigates and destroyers.

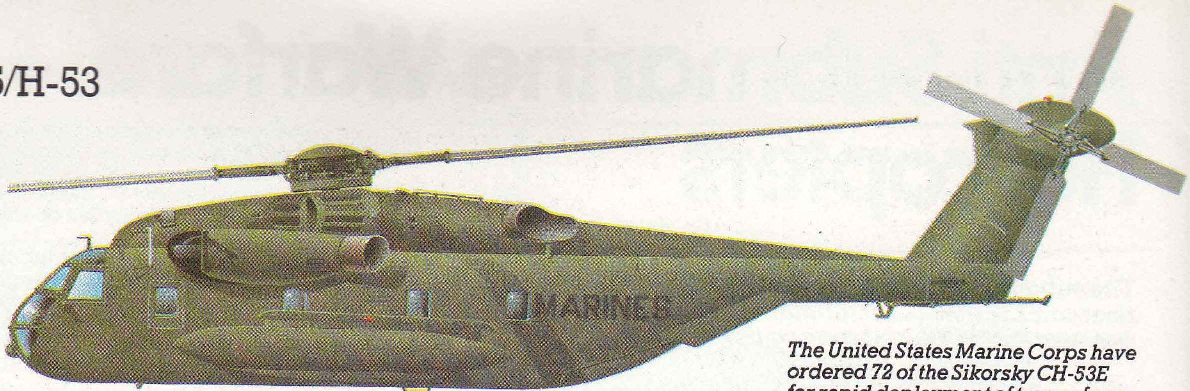
A derivative of the US Army's UH-60 Black Hawk, now entering widespread service with combat formations as a successor to the venerable Bell UH-1 series, the **Sikorsky SH-60B Seahawk** (produced under the company designation **S-70L**) won the US Navy's LAMPS III (Light Airborne Multi-Purpose System) competition in September 1977, and will be deployed aboard all the newest USN destroyers and frigates. A large, complex and extremely expensive machine, the SH-60B has two main missions: ASW and ASST, the latter meaning anti-ship surveillance and targeting (the aerial detection of incoming sea-skimming anti-ship missiles, and the provision of radar-derived data for similar weapons launched from US warships. Secondary missions include SAR, medevac (casualty evacuation) and vertrep (vertical replenishment, ie bringing supplies to warships at sea). The basic airframe differs from that of the UH-60 in being marinized, with a sealed tailboom, tailwheel moved forward quite considerably and inflatable bags for emergency buoyancy, and with an electrically folding main rotor and pneumatically folding tail (including upward-hinged tailplanes). Other modifications are greater fuel capacity and the removal of armour for the pilot and co-pilot, and the type is also fitted with haul-down equipment to facilitate recovery onto small platforms when ships are pitching and rolling in heavy seas. Under the nose is the large APS-124 radar, on the left side of the fuselage is a large vertical panel with 25 tubes for launching sonobuoys, low on the right of the rear fuselage is the pylon from which the MAD bird can be towed and there is extensive EW, navigation (including Doppler) and data processing equipment. The first prototype flew on 12 December 1979. By 1983 deliveries were beginning of a planned total of 204 for the US Navy, which hopes to have the type operational in 1984, and foreign sales are being sought.

Specification
Sikorsky SH-60B Seahawk
Type: multi-role shipboard helicopter
Armament: normally two Mk 46 anti-submarine torpedoes, but planned to include anti-ship missiles
Powerplant: two 1,690-shp (1261-kW) General Electric T700-401 turboshafts
Performance: maximum speed 234 km/h (145 mph); range about 373 km (500 miles)
Weights: empty 6300 kg (13,889 lb); maximum take-off 9926 kg (21,884 lb)
Dimensions: main rotor diameter 16.36 m (53 ft 8 in); fuselage length 15.26 m (50 ft 0¾ in); height 3.63 m (11 ft 11 in); main rotor disc area 210.05 m^2 (2,261 sq ft)

In common with most US Navy aircraft, the SH-60B Seahawk flies in low-visibility grey, with toned-down national markings. The machine carries an impressive array of radar and sensors to enable it to detect submarines and hostile sea skimming missiles, and to direct missiles from its mother ship.

USA

Sikorsky S-65/H-53



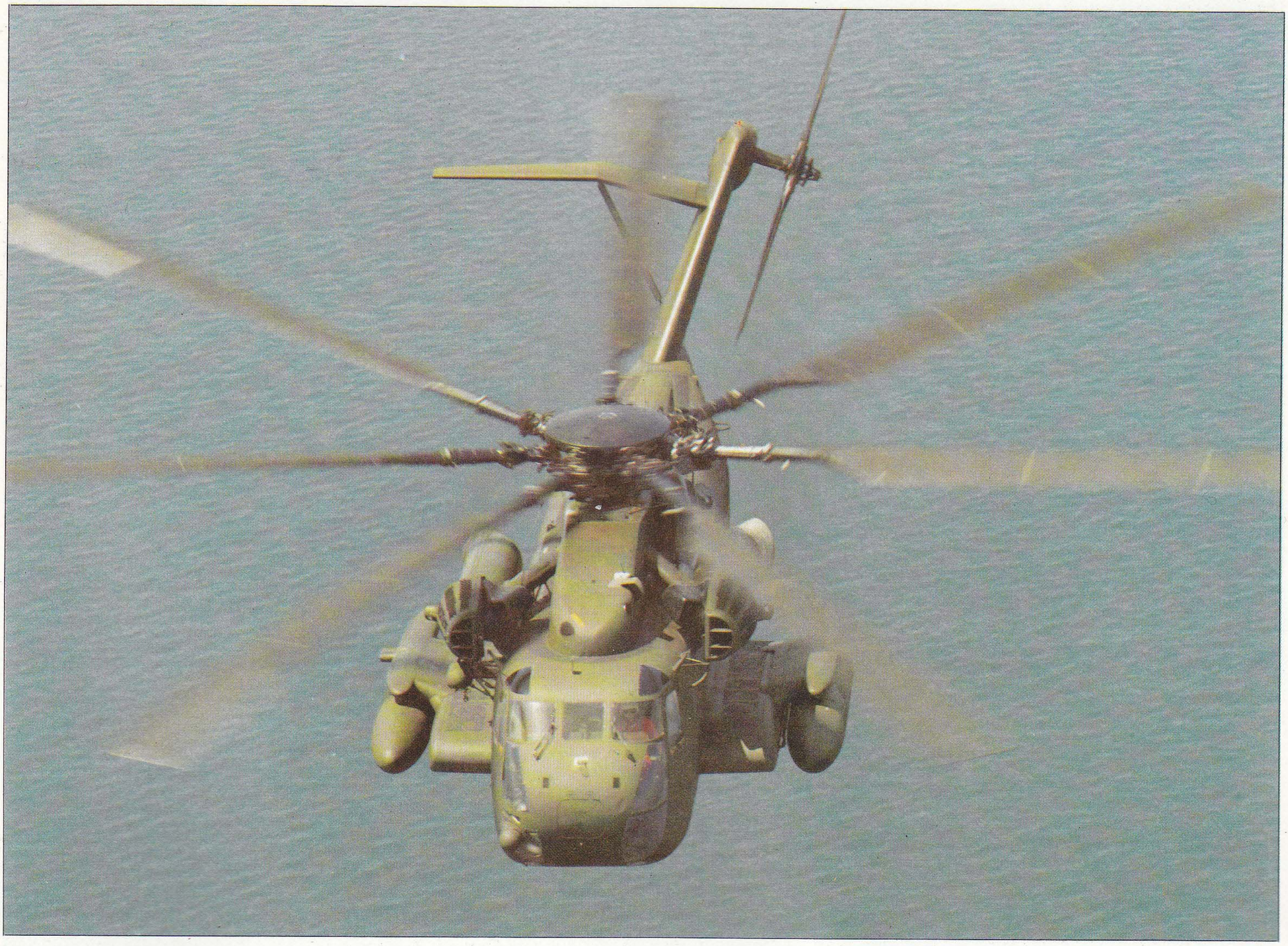
The United States Marine Corps have ordered 72 of the Sikorsky CH-53E for rapid deployment of troops from ship to shore. These massive machines are the largest helicopters outside the USSR, with a lift capability of 14515 kg (32,000 lb).

Though the original **Sikorsky S-65** production model, the **CH-53A** assault transport of the US Marine Corps, has only two engines each of 2,850 shp (2125 kW), today's **CH-53E** has three engines each of 4,380 shp (3266 kW) and is the most powerful helicopter ever built outside the Soviet Union. Of the early versions, all are transports (139 CH-53As and 126 of the more powerful **CH-53D**, all for the US Marines) except for 15 transferred to the US Navy as **RH-53A** minesweeping machines, used to explore the possibilities of this new technique which had previously been tried only with machines of inadequate power, and the 20 **RH-53D** special-purpose machines with droptanks and inflight-refuelling probes, some of which were used in the unsuccessful mission to rescue Americans from imprisonment in Iran in April 1980. Today the chief versions are based on the CH-53D, which though hardly any larger has far greater power, a greatly modified airframe which folds for shipboard use, and the first seven-blade main rotor to be used (the even larger Soviet Mi-26 has an eight-blade rotor). The CH-53E was developed to meet a 1973 demand for an upgraded heavy-lift transport for the US Navy and US Marine Corps. With three much more powerful engines driving into a new transmission rated at 13,140 hp (9798 kW), the new machine can carry payloads almost equal to the laden weight of the first version, though the main cabin is almost unchanged in dimensions and still seats a maximum of 55 troops. The CH-53E scores in its vastly increased lifting ability, without occupying significantly more deck space yet retaining compatibility with existing ships. The first production CH-53E flew on 13 December 1980, and by mid-1983 more than 40 had been delivered out of 72 ordered. In addition Sikorsky is developing the derived **MH-53E** as a definitive MCM (mine countermeasures) helicopter, with very comprehensive minesweeping gear using all existing or planned MCM devices. Enormously enlarged side sponsons accommodate an extra 3785 litres (833 Imp gal) of fuel, for extended sweeping missions with the engines at sustained high power. The MH-53E will also be used in the vertrep (vertical replenishment of ships) role, and has been made compatible with the cargo hold of the Lockheed C-5 Galaxy in order that it can be deployed rapidly anywhere in the world. The production prototype MH-53E was expected to fly in September 1983, and deliveries of a planned total of 57 are expected to start in late 1986.

Specification

CH-53E

Type: heavy shipboard assault transport
Powerplant: three 4,380-shp (3266-kW) General Electric T64-416 turboshafts
Armament: normally none
Performance: maximum speed 315 km/h (196 mph); cruising speed at sea level 278 km/h (173 mph); ferry range 2075 km (1,290 miles)
Weights: empty 15071 kg (33,226 lb); maximum take-off 33339 kg (73,500 lb)
Dimensions: main rotor diameter 24.08 m (79 ft 0 in); length overall 30.19 m (99 ft 0½ in); height 8.66 m (28 ft 5 in); main rotor disc area 455.38 m^2 (4,902.0 sq ft)



Seven rotor blades are needed to transmit the colossal power of the CH-53E. This model is easily distinguished by a smooth rear fuselage and larger fin which is inclined to the left. The tailplane has to be gull-winged to bring the outboard portion horizontal.

Anti-Submarine Warfare Helicopters

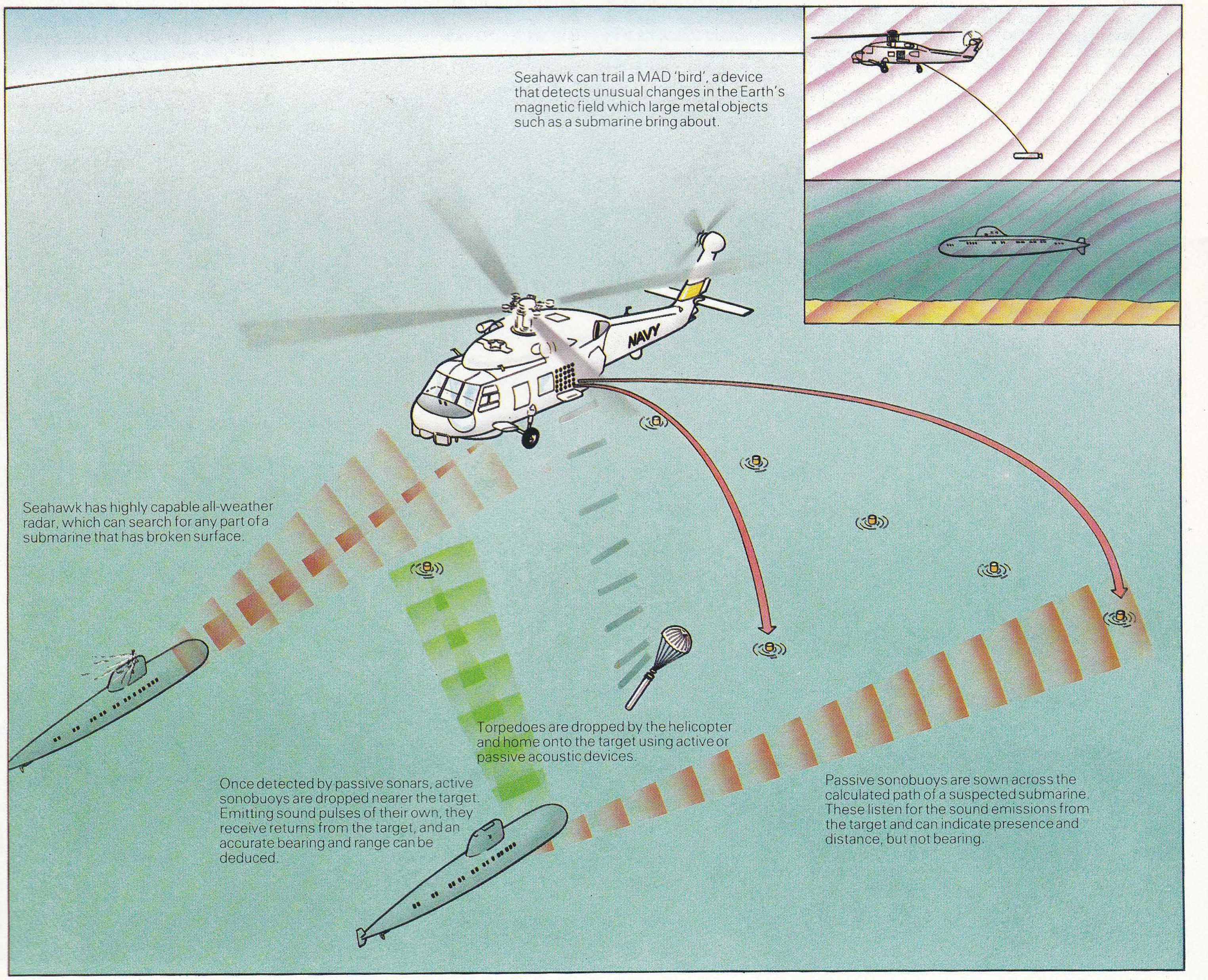
The submarine poses the greatest and most feared threat to a fleet commander. Anti-submarine warfare helicopters are his greatest asset in this unseen war of the deep.

ASW (anti-submarine warfare) was the very first active combat duty of the earliest helicopters in World War II. Those machines were embarked aboard surface warships but could not do more than search for submarines with the human eye, and on occasion carry a depth charge weighing about 400 lb (181 kg). By the 1950s much more powerful helicopters could carry heavier loads of weapons, and Bell built a small number of HSL-1 tandem-rotor machines, with 1,900-hp (1417-kW) engines, which were designed purely for the ASW role. The HSL-1s were not particularly useful, and as with other classes of helicopter the whole picture was transformed by the switch to turbine engines.

In the case of the ASW helicopter an extra benefit was that turbine engines eliminated the need for the ship to carry large tanks full of high-octane gasoline (petrol), and many modern helicopters can even burn the same heavy 'Bunker C' fuel oil as the ship itself. With abundant power available, the modern ASW helicopter can carry both the sensors needed to find the submarine and the weapons to destroy it, and thus do what is called a hunter/killer job. The main sensors are radar (useless against completely submerged vessels), sonobuoys which are in effect 'underwater radar' using high-intensity sound waves, and MAD (magnetic-anomaly detection) which detects the extremely small distortion of the terrestrial magnetic field caused by the presence of a large mass of metal such as a submerged submarine. Sonobuoys are probably the most important sensor, and unlike other aircraft the helicopter has the choice of dropping small buoys into the sea or of 'dunking' a single very large buoy on the end of a cable. A large buoy can be more sensitive and detect a target over a greater distance.

The chief ASW weapon used by helicopters is the homing torpedo, typically of 12.75-in (324-mm) diameter and weighing about 500 lb (227 kg). Most such torpedoes have acoustic homing guidance, but they are released as close as possible to the actual or predicted position of the target submarine, and it is here that the ASW helicopter scores over surface ships or fixed-wing aircraft. Unlike these alternative systems the helicopter can track a submerged submarine accurately and stay with it, no matter how slow or fast it may travel. Put another way, even the latest nuclear submarine finds a helicopter extremely difficult to escape, provided that the helicopter is equipped with effective sensors. Fixed-wing aircraft cannot fly sufficiently slowly to stay 'on top' of the submarine, while surface ships cannot move fast enough.

It is worth noting that the latest British ASW helicopters, the Westland Sea King HAS.Mk 5 and Westland Lynx HAS.Mk 2, rely primarily on advanced dipping sonar equipment, whereas the most recent American machine, the Sikorsky SH-60B Seahawk, does not carry such a sensor and instead has a 25-tube launcher for expendable sonobuoys. The Russian Kamov Ka-25 in its 'Hormone-A' ASW version carries both a large dipping sonar and a canister of small buoys. Modern ASW machines carry an acoustic processor, an advanced digital computer which receives the signals from all sonics equipment (dipping or dispensed), analyses and classifies them and presents the crew with numerical and graphic information on the presence and location of targets. Many ASW aircraft have communications systems which enable sensor information from one to be passed to another, or the computer of one to communicate with the computer of another aircraft or ship, so that the anti-submarine operation can be conducted on a team basis with little need for voice contact.



Seahawk can trail a MAD 'bird', a device that detects unusual changes in the Earth's magnetic field which large metal objects such as a submarine bring about.

Seahawk has highly capable all-weather radar, which can search for any part of a submarine that has broken surface.

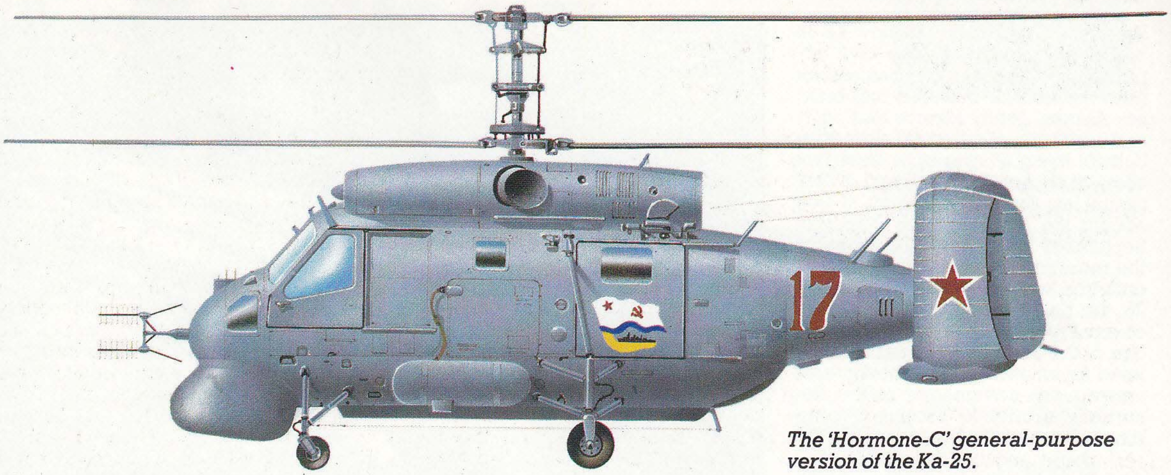
Torpedoes are dropped by the helicopter and home onto the target using active or passive acoustic devices.

Once detected by passive sonars, active sonobuoys are dropped nearer the target. Emitting sound pulses of their own, they receive returns from the target, and an accurate bearing and range can be deduced.

Passive sonobuoys are sown across the calculated path of a suspected submarine. These listen for the sound emissions from the target and can indicate presence and distance, but not bearing.

USSR

Kamov Ka-25 'Hormone'



Called **'Hormone'** by NATO, the compact **Kamov Ka-25** helicopter has appeared in various sub-types which have since 1965 been the standard type carried aboard Soviet surface warships for defensive and offensive roles. The traditional Kamov layout with superimposed coaxial rotors reduces disc diameter, and in any case automatic blade folding is provided for stowage in small hangars. The four-legged landing gear is specially tailored to operation from pitching decks, each leg having an optional quick-inflating flotation bag which gives the 'Hormone' a distinctly unusual appearance. The rear legs can be raised vertically, on their pivoted bracing struts, to lift the wheels out of the vision of the search radar always fitted under the nose. Two radars have been identified. The smaller type is carried by the **'Hormone-A'** variant on ASW missions; this model also has a towed MAD bird, dipping sonar, electro-optical sensor (and possibly others), and an optional right-side box of sonobuoys. A larger radar is fitted to the **'Hormone-B'**, which is believed to be able to guide the SS-N-12 'Sandbox' cruise missile fired from friendly surface ships and, especially, submarines. Many other equipment items include a cylindrical container under the rear of the cabin and a streamlined pod under the tail. In 1982 Ka-25s were seen without flotation gear but with a long ventral box housing (it is believed) a long wire-guided torpedo. All Ka-25s have a large cabin normally provided with 12 folding seats additional to those for the crew of two pilots plus three systems operators. Some 460 of all variants were built by 1975, and the type continues to play an important part in Soviet naval operations, operating from destroyers, cruisers, helicopter carriers (18 are believed to be carried on each of the two ships *Moskva* and *Leningrad*) and aircraft carriers (*Kiev* and *Minsk* each accommodate 16 'Hormone-A' and three 'Hormone-B' helicopters). The type has also been exported for ship- and land-based operations. The last variant is the **'Hormone-C'** search-and-rescue helicopter based on the 'Hormone-A' without the latter's mission equipment. The 'Hormone' will remain in service for some years to come.

Specification

Kamov Ka-25 'Hormone'

Type: multi-role shipboard helicopter

Armament: normally equipped with ventral bay or external box for two AS torpedoes, nuclear or conventional depth charges and other stores

Powerplant: two 990-shp (739-ekW) Glushenkov GTD-3BM turboshafts

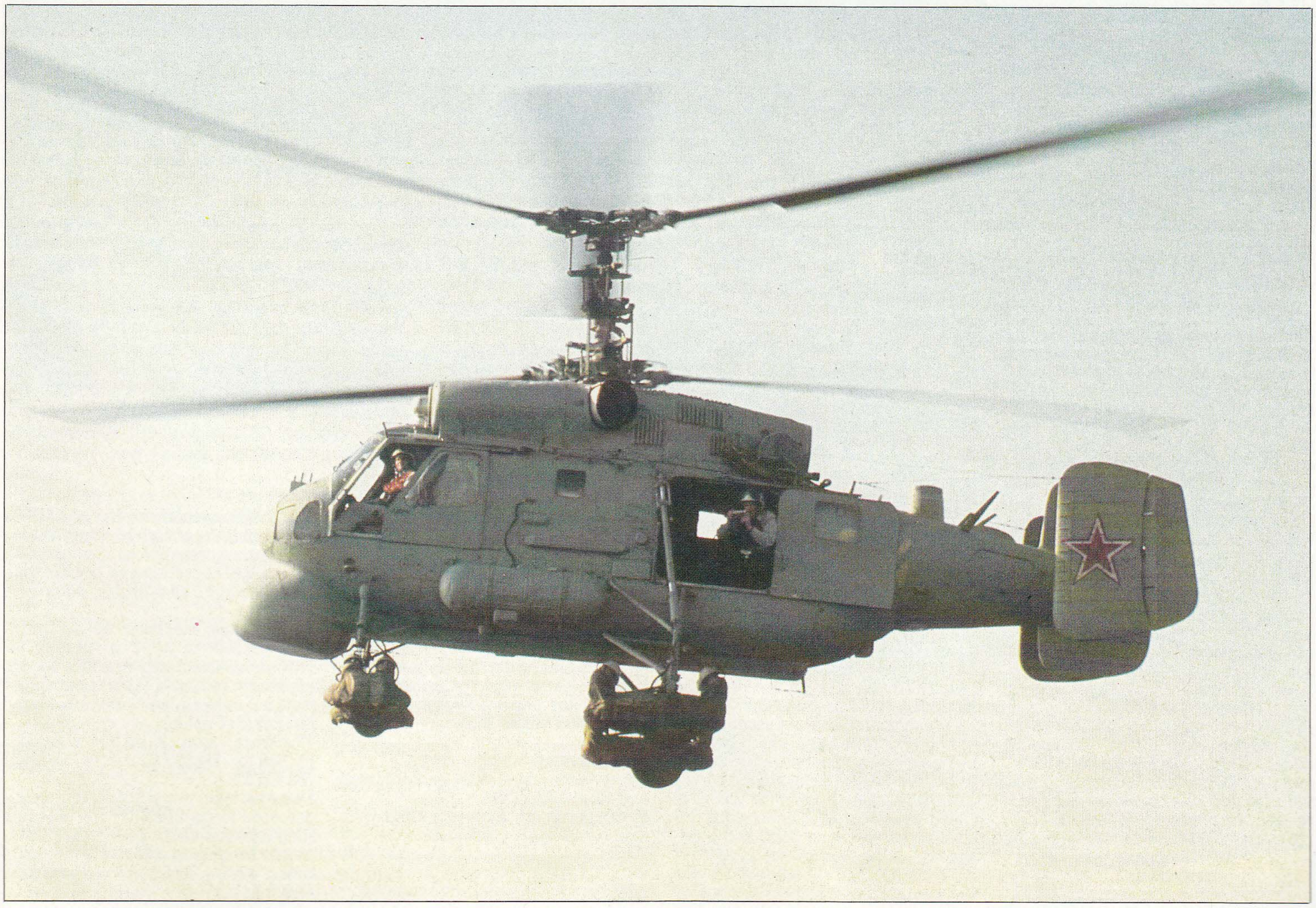
Performance: maximum speed 209 km/h (130 mph); range with external tanks 650 km (405 miles)

The 'Hormone-C' general-purpose version of the Ka-25.

Weights: empty about 4765 kg (10,500 lb); maximum 7500 kg (16,500 lb)

Dimensions: main rotor diameter (both) 15.74 m (51 ft 8 in); fuselage length 9.75 m (32 ft 0 in); height 5.37 m (17 ft 7½ in); main rotor disc area (combined) 389.7 m^2 (4,193.0 sq ft)

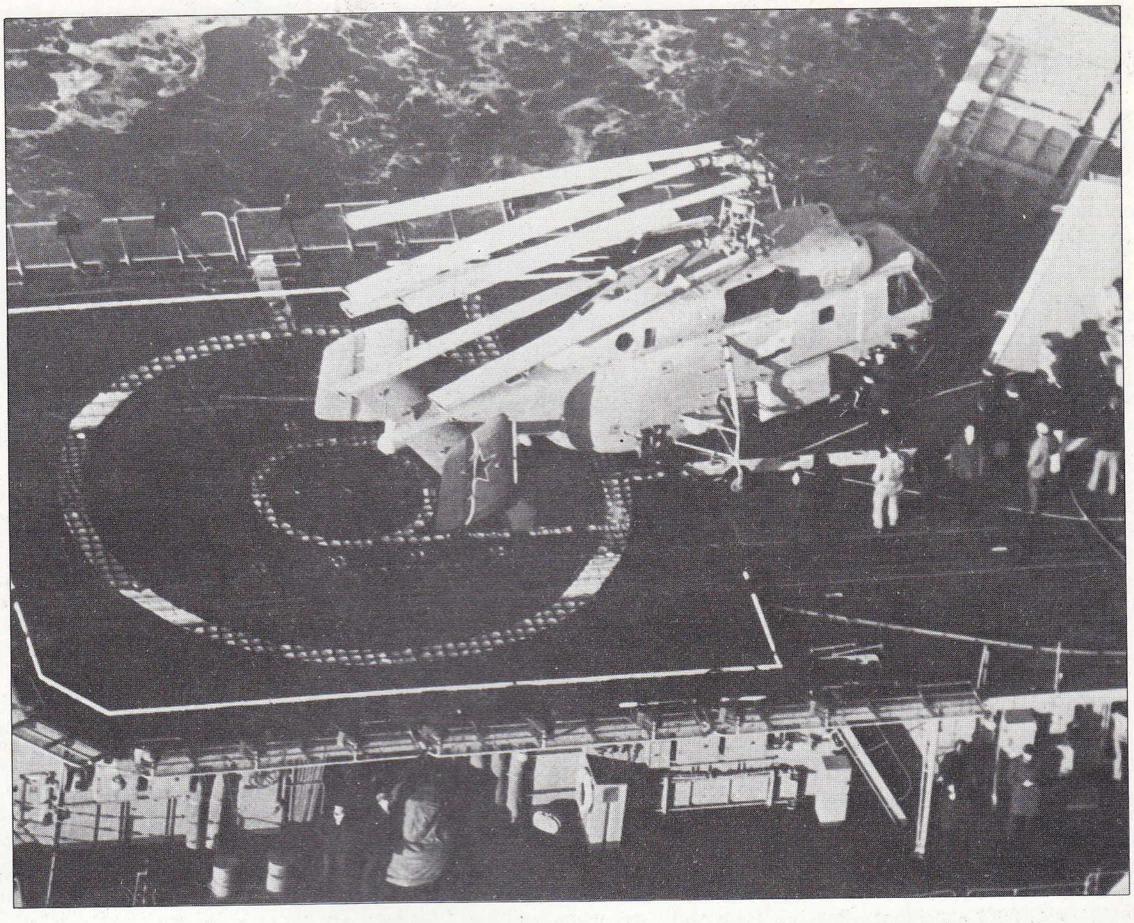
Ka-25 'Hormone-C', used for utility duties such as light transport and SAR. The ungainly four-leg undercarriage is extremely stable on deck, and has rapidly inflating flotation bags on each leg in case of ditching.



USSR

Kamov Ka-32 'Helix'

Early publicity of the **Kamov Ka-32 'Helix'** was associated with civil applications, including reconnaissance from the nuclear-powered icebreakers *Arktika, Lenin, Rossiva* and *Sibir*, and all forms of transport and agricultural flying. Photographs were first taken of an Aeroflot (civil) and AVMF (naval air force) examples at sea aboard the new destroyer *Udaloy* in September 1981, and NATO allocated the reporting name 'Helix'. Clearly an enlarged successor to the familiar Ka-25, the Ka-32 has similar three-blade co-axial rotors (each negating the torque of the other and so removing the need for an anti-torque tail rotor, with consequent advantages in the designers' ability to reduce overall dimensions) but the blades are of different shape and increased diameter. All fold to the rear for stowage in ship hangars. The fuselage is considerably more capacious than that of the Ka-25, and it is estimated that in a utility role the Ka-32 could carry 14 troops or substantial quantities of cargo: the civil version is described as able to lift slung loads up to 5000 kg (11,023 lb), and carry such a load over a range of 185 km (115 miles). The ASW version, known in the West as **'Helix-A'**, has a large box on each side (probably for sonobuoys), a box under the tail boom (probably for a MAD), a large chin radar and extremely comprehensive avionics including EW installations. **'Helix-B'** is a targeting aircraft for anti-ship missiles, intended as a replacement for the Ka-25 'Hormone-B'. From the Soviet navy's point of view, the real advantage of the Ka-32 series is that while the overall dimensions are little altered from those of the Ka-25, permitting the type to use existing platforms and hangars, payload and general utility have been enhanced considerably.



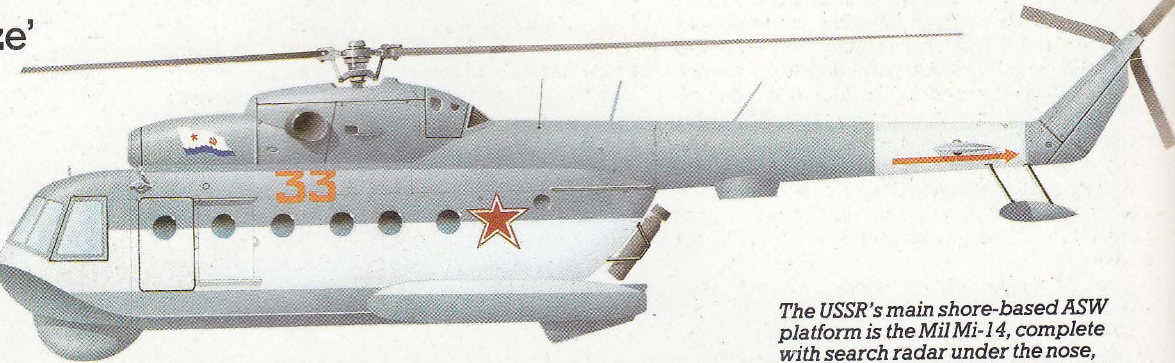
The Kamov Ka-32 'Helix' only entered service in late 1981, and photographs are rare. This 'Helix-A' anti-submarine helicopter is seen on the deck of the guided-missile destroyer Udaloy.

Specification

Kamov Ka-32 'Helix-A'
Type: ASW and multi-role naval helicopter
Armament: includes AS torpedoes
Powerplant: two turboshafts, probably uprated Glushenkov GTD-3BM type of about 1,200 shp (895 kW) each
Performance: not yet known, but range with 5-tonne payload said to be 185 km (115 miles)
Weights: empty about 5750 kg (12,680 lb); maximum take-off probably about 9000 kg (19,840 lb)
Dimensions: (estimated) main rotor diameter 16.75 m (54 ft 11½ in); fuselage length 11.0 m (36 ft 1 in); height 5.5 m (18 ft 0½ in); main rotor disc area 440.0 m^2 (4,736 sq ft)

USSR

Mil Mi-14 'Haze'



The USSR's main shore-based ASW platform is the Mil Mi-14, complete with search radar under the nose, towed MAD bird (stowed behind the rear fuselage), and dipping sonar.

Also known to the design bureau as the **V-14**, the **Mil Mi-14 'Haze'** is a large twin-turbine helicopter and has some kinship with the mass-produced Mi-8 but has the more powerful TV3 type engines of the Mi-17 and Mi-24. The fuselage is totally different from any other Mil helicopter, and has much in common with the Sikorsky S-61R, the boat-hulled transport version of the Sea King, in that it is fitted with nose-wheel type landing gear with the main units retracting into rear sponsons which also incorporate water keels. The Mi-14 was designed in the 1960s as the replacement for the piston-engine Mi-4 'Hound' as the Soviet AV-MF (naval air force) shore-based ASW and multi-mission helicopter. It is too large for convenient operation from ships, where the Ka-25 'Hormone' and Ka-32 'Helix' are used. The numbers deployed are small, the estimate in mid-1983 being only 65 for the AV-MF and 12 for Bulgaria. The cockpit houses the pilot and co-pilot, who have comprehensive navaids including Doppler, search radar with 360° surveillance, a radar altimeter and full de-icing equipment, though there are no inlet screens on the engines. In the large main cabin, which in transport versions can be equipped with 32 seats, a mission crew of three or four sit round a tactical display served by the radar, a towed MAD (magnetic anomaly detection) 'bird' and dipping sonar. The hull is watertight and has limited amphibious capability, but the Mi-14 is not intended for sustained operations from the open sea. Some examples have additional radio aerials and a few have a rescue hoist above the large sliding door on the left side. Fuel is housed in large tanks along the sides under the main floor, and possibly also in the rear sponsons, leaving the central compartment free for use as a weapon bay, with belly doors. Details of what can be carried are not yet known, and no Mi-14 has been seen with externally mounted weapons. In addition to the basic ASW version, it is probable that a transport version exists for utility and SAR roles. Because of its size, this model would probably not be suitable for vertrep (vertical replenishment of ships) role.

Specification

Type: shore-based ASW (possibly also anti-ship) helicopter
Powerplant: two 2,200-shp (1641-kW) Isotov TV3-117A turboshafts
Armament: certainly includes AS homing torpedoes and/or depth charges; may also include anti-ship missiles
Performance: maximum speed probably same as Mi-8 at 260 km/h (161 mph); maximum cruising speed probably 240 km/h (149 mph); range with full mission load probably about 500 km (311 miles)
Weights: empty about 8000 kg (17,650 lb); loaded probably 12000 kg (26,455 lb)
Dimensions: main rotor diameter assumed to be 21.29 m (69 ft 10½ in); length overall about 25.30 m (83 ft 0 in); height on ground 5.65 m (18 ft 6½ in); main rotor disc area 355.0 m^2 (3,828.0 sq ft)

Saudi Arabia

The Saudi Army

A measure of the mediaeval nature of the Saudi state can be seen in the fact that it has in effect two national armies, one set to keep the other in check. The regular army was formed to keep a balance against the largely Bedouin *Ikhwan*, a basically guerrilla force that was used to oust the Turks from the region in the early part of the 20th century and thus make Saudi Arabia an independent nation. The *Ikhwan* has now been formalized into the National Guard but retains its direct allegiance to the monarch, and many of its units are still virtual levies.

The regular army is some 35,000 strong and is centred in four specially-built 'military cities' at Tabuq, King Khalid Military City (Hafar al-Batin), Assad Military City (Al-Kharj) and Khamis Mushayt. Each city usually has its own air base and is heavily defended by SAM missiles. The army's stance is defensive and has internal security duties as reflected in the three battalions of the Royal Guard Regiment, who act as personal bodyguards for the 7,000-strong royal family and its retinue. The main strength of the army is in the armoured brigade (there is another in cadre form only) formed around a strength of some 300 French AMX-30 tanks and a smaller number (around 150) of American M60A1 and M60A3 tanks. There are also two mechanized brigades, an airborne brigade and two infantry brigades equipped with a confusing mix of French AML-60 and AML-90 armoured cars (200), British Fox (100) and Scorpion reconnaissance vehicles, Brazilian Engesa armoured cars and missile-armed VCC-1s (200). Personnel carriers include American M113s (over 600) and French Panhard M-3s and AMX-10Ps (60). Artillery support is provided by four battalions armed with a further confusing mix of French 155-mm (6.1-in) GCT self-propelled guns, American M110 203-mm (8-in) self-propelled howitzers and numerous towed guns including American 105-mm (4.13-in) M101s and M102s, 155-mm (6.1-in) M198s and at least 72 155-mm (6.1-in) FH-70 modern guns.

Anti-aircraft defence is a major component of the army with no less than 18 AA artillery battalions and a further 18 SAM battalions. The artillery battalions use 90-mm (3.54-in) AA guns and M42 40-mm, AMX-30SA 30-mm and M163 20-mm Vulcan self-propelled AA guns plus a number of smaller-calibre equipments. The SAM batteries use Redeye, Shahine, SICA and Improved HAWK. There are also numerous TOW, HOT and Dragon anti-tank missiles and numerous 106-mm (4.17-in) recoilless rifles mounted on Land Rovers and Jeeps for anti-tank defence.

The National Guard has its own military cities at Al-Hasa and Qassim. Al-Hasa is in the oilfields of the Eastern Province and the National Guard is used almost exclusively for the defence and security of these wealth-making assets. On paper the National guard has a strength of over 25,000, but many of these are irregulars raised on a tribal basis for short-term duty tours. They maintain four all-arms battalions, 16 infantry battalions plus a further 24 irregular infantry battalions. They have at least 240 American Commando armoured cars for support plus a force of towed M102 105-mm (4.13-in) howitzers and AA guns (20-mm Vulcan and 90-mm/3.54-in). They also provide a ceremonial cavalry squadron.

The Saudi Navy

The Saudi Navy is a defensive coastal force only some 2,200 men strong. It uses a number of American Harpoon-equipped missile corvettes, American-built fast attack craft (missile) and FAC (torpedo), and a fleet of well over 50 small coastal craft. There are at least four old American minesweepers and some new logistic support ships. The force will be considerably bolstered by four West German missile frigates in the mid-1980s. The main bases are at Al Qatif/Jubail and Jiddah. The navy maintains a coastal defence force based on the Franco-Italian Otomat missile and there is a small air component planned round two Dassault Atlantic Nouvelle Génération maritime reconnaissance aircraft, and 24 Aérospatiale SA 365F Dauphin 2 helicopters, most armed with AS.15TT anti-ship missiles. The Saudi navy is currently undergoing a programme of expansion.

Saudi Arabia maintains a coastguard with at least 90 small patrol boats and a number of helicopters. It also operates eight SRN-6 hovercraft.

The Saudi Air Force

The Royal Saudi Air Force is the most advanced of all the Saudi armed forces and is equipped with modern aircraft. Although the air force is relatively small (15,000 men) it forms the basis of an integrated air defence network with many components formed from the air wings of neighbouring states such as Kuwait and Qatar. It has two interceptor squadrons now converting to McDonnell Douglas F-15C Eagles from 17 elderly BAe (BAC) Lightnings, many of which are now being placed in reserve to join 17 already in such a state. There are three strike squadrons using about 65 Northrop F-5Es with four more on order. Some 23 F-5F two-seaters and older F-5B two-seaters (15) are also used by an OCU with an operational role if required, and there is also an OCU for the F-15 squadron at present forming. Three transport squadrons use Lockheed C-130 Hercules (10 C-130Es and 26 C-130Hs) along with six KC-130H tankers, and two Lockheed JetStars are used by the royal family and other VIPs; other VIP aircraft are two VC-130Hs, one Boeing 707-320, three helicopters and two C-130H flying hospitals. There are at least two helicopter squadrons with a number of detached flights using a mix of Agusta-Bell AB.205 (12), Agusta-Bell AB.206 (12), Agusta-Bell AB.212 (10), Aérospatiale Alouettes III (2) and a single Bell 212 helicopter. Training is carried out on BAe 167 Strikemaster Mk 80As (now only a few out of 46 left serviceable) and 12 Cessna 172s. Search and rescue is the responsibility of 18 Kawasaki KV-107-IIs.

On order are five Boeing E-3A Sentry AWACS aircraft with six Boeing Model 707 tankers for support. Some 40 Spanish CASA C-212-200 transports (built in Indonesia) are also on order, as is a Boeing 747, and no less than 1,177 AIM-9L Sidewinder AAMs and 916 AGM-65 Maverick ASMs. The delivery of 10 Northrop RF-5E Tigereye aircraft will add a useful reconnaissance capability. Total F-15C and F-15D requirement is 45 and 15 respectively.

Order of Battle

Army

Two armoured brigades (one cadre)
Two mechanized infantry brigades
Two infantry brigades
One airborne brigade (two parachute battalions plus one special forces company)
One Royal Guard Regiment
Four artillery battalions (one more to be formed soon)
18 anti-aircraft artillery battalions
18 surface-to-air missile battalions (16 with Improved HAWK and two with 12 Shahine, SICA systems with 48 missiles)

National Guard

Four all-arms battalions
16 regular infantry battalions
24 irregular infantry battalions
Various support units

Navy

Four 'F 200' class frigates (on order)
Four 'Badr' class corvettes with Harpoon missiles
Five 'Al Siddiq' fast attack craft with Harpoon missiles (four more on order)
Three 'Jaguar' class fast attack craft (torpedo)
Four coastal minesweepers
One large patrol craft
Two logistic support ships (on order)
53 coastal patrol craft
Six landing craft
Two Dassault-Breguet Atlantic ATL 2 (on order)
24 Aérospatiale SA 365F Dauphin 2 (on order)

Air Force

Two interceptor squadrons (BAC/BAe Lightning F.Mk 53/T.Mk 55 and McDonnell Douglas F-15C Eagle)
Three strike squadrons (Northrop F-5E)
One reconnaissance flight (Northrop RF-5E)
Two OCU (Northrop F-5B, Northrop F-5F and McDonnell Douglas F-15D Eagle)
Three transport squadrons (Lockheed C-130E, C-130H and KC-130H)
Two helicopter squadrons (Agusta-Bell AB.205, AB.206 and AB.212)
VIP unit (Lockheed VC-130H, Boeing 747SP, Boeing 707-320, Lockheed VC-140 JetStar, Agusta-Bell AB.206, Agusta-Sikorsky AS-61A-4)
Search-and-rescue unit (18 Kawasaki KV-107-II)
Training units (BAe Strikemaster Mk 80A and Cessna-Reims 172G/172H/172M)

A flight of British Aerospace Strikemaster Mk 80s formate over the tough Saudi terrain. The Strikemaster is used for advanced training and ground attack, but attrition has been high.

RSAF
1130
ROYAL SAUDI AIR FORCE
RSAF